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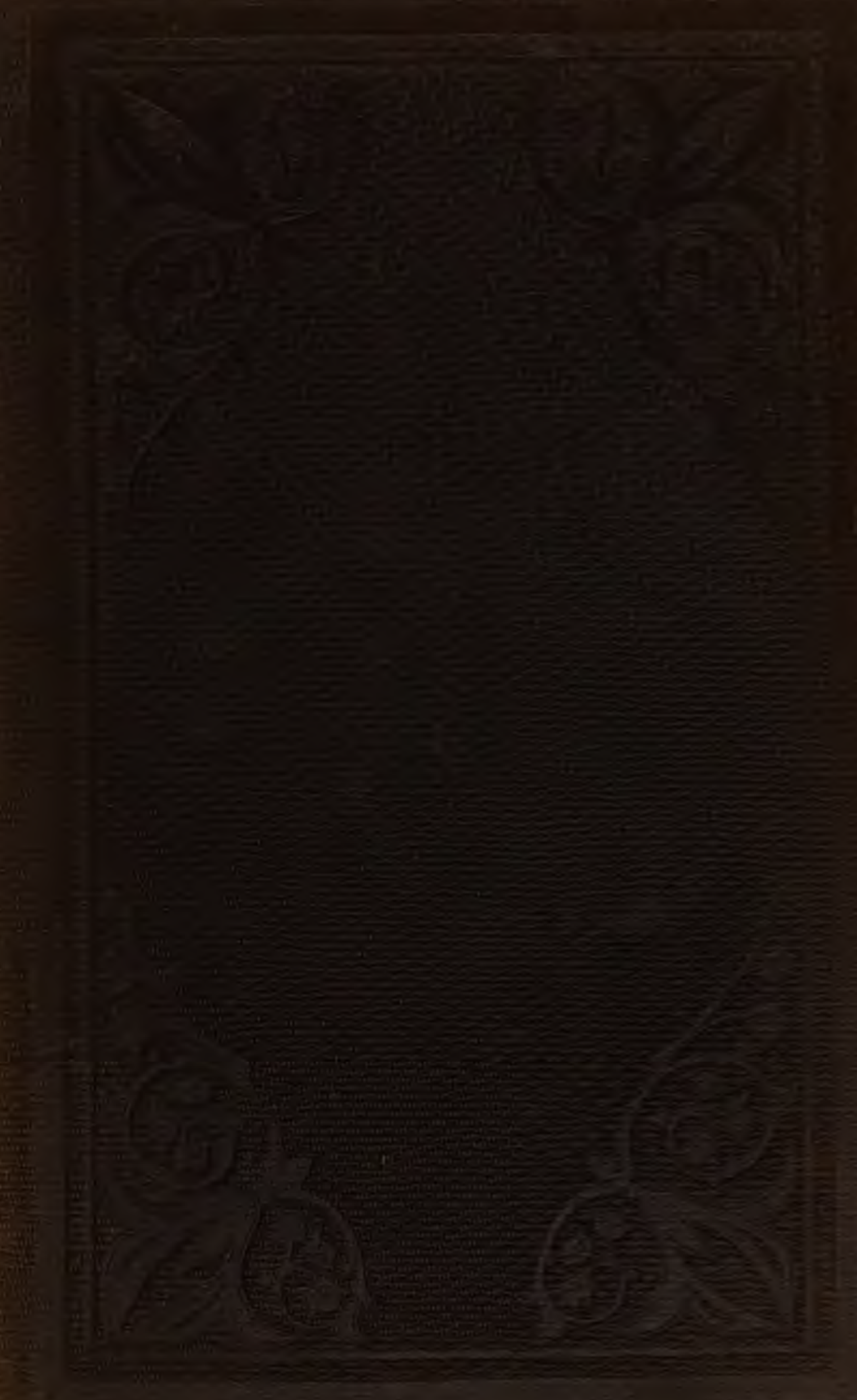

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OF THE

LITERARY AND PHILOSOPHICAL SOCIETY

OF

NOTICE.

Owing to unavoidable circumstances, the paper of Dr. Ginsburg on the KABBALAH, for which the publication of this Volume has been delayed for some months past, is not yet completed. It is therefore deemed desirable to issue the present Volume without it, and the paper will appear in the succeeding Volume, which it is hoped may be ready about July or August.

N.B.—The paper by Mr. Williams on a new species of Chætopterus has meanwhile appeared in the Linnæan Transactions, the Annelid being named by Dr. Baird, Chætopterus *insignis*.

EDITOR.

LONDON:
LONGMAN, GREEN, LONGMAN, ROBERTS, & GREEN.
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This Volume has been edited by the Hon. Secretary.

The Authors have revised their papers.

The Authors alone are responsible for facts and opinions.

The Society exchanges Proceedings with other publishing bodies, through the Secretary, from whom back numbers may be obtained.

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SESSION LIII., 1863-64.

President:
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S. H. BEHREND, M.A., Lond.
Rev. JOSHUA JONES, M.A., Oxon.

ORDINARY MEMBERS,

ON THE SOCIETY'S ROLL AT THE CLOSE OF THE 53RD SESSION.

Those marked + are Original Members of the Society.
Life Members are marked with an asterisk.

Jan. 26, 1863 Abbott, Joseph, B.A., *Liverpool College*, and 73, *Spencer-street*, *Everton*.
Oct. 11, 1833 Aikin, James, 2, *Drury-lane*, and 4, *Gambier-terrace*.
Dec. 10, 1860 Alexander, James, 8, *York buildings*, *Dale-street*, and *Southport*.
Jan. 8, 1861 Anderson, David, 5, *Castle-street*, and 7, *Church-street*, *Egremont*.
Dec. 11, 1854 Andrew, John, *Fenwick chambers*, and *Sandown-park*, *Wavertree*.
Mar. 7, 1864 Archer, F., jun., B.A., Trin. Coll., Cantab., 10, *Rodney-street*.
*Nov. 28, 1853 Archer, T. C., F.R.S.E., F.R.S.S.A., Director of the Industrial Museum of Scotland, *Edinburgh*.

Dec. 14, 1863	Ashe, Theoph. Fielding, 45, *South Castle-street*, and 4, *Dingle-lane.*
Feb. 22, 1855	Avison, Thomas, F.S.A., 18, *Cook-street*, and *Fulwood-park, Aigburth.*
Dec. 10, 1860	Baar, Rev. Hermann, Ph. D., 98, *Bedford-street South.*
Jan. 11, 1864	Bagshaw, John, 87, *Church-street*, and 36, *Bedford-street North.*
May, 1, 1854	Bahr, G. W., 4, *Cable-st.* and 2, *South-hill Grove, Aigburth.*
May 4, 1863	Bailey, Fras. J., M.R.C.S., 48, *Oxford-street.*
Dec. 15, 1862	Balman, Thomas, M.D., 6, *Bedford-street South.*
Oct. 29, 1860	Banister, Rev. W., B.A., *St. James's Mount.*
Jan. 13, 1862	Baruchson, Arnold, 35, *Dale-street*, and *Blundell sands, Great Crosby.*
Nov. 3, 1862	Behrend, Saml. H., M.A., 24, *Clarendon-rooms*, and 15, *Canning-street.*
Mar. 9, 1857	Bell, Christopher, *Moor-st.*, & 60, *Bridge-st., Birkenhead.*
Feb. 6, 1854	Bennett, William, *St. George's-place, Lime-street*, and 109, *Shaw-street.*
Nov. 2, 1863	Billson, Alfred, 46, *Castle-street*, and 14, *Sandon street.*
Oct. 31, 1859	Birch, Jas., 13, *The Temple, Dale-st.*, & 7, *Upper Baker-st.*
Jan. 25, 1864	Birchall, James, *Industrial Schools, Kirkdale.*
Feb. 4, 1856	Bird, W. V., M.D., Aberd., *Church-street, Egremont.*
April 15, 1861	Blake, James, 63, *Kitchen-street*, and 45, *Canning-street.*
Oct. 31, 1859	Bloxam, Frederick William, *Alliance Bank, Brown's-buildings*, and 157, *Islington.*
Jan. 12, 1863	Bolton, Ogden, *Prince's-buildings, Harrington-street*, and 10, *Great George-square.*
*Mar. 6, 1835	Boult, Swinton, 1, *Dale-street*, and 3, *Bedford-street South.*
Oct. 21, 1844	Bright, Samuel, 1, *North John-street*, and *Sandheys, Mill-lane, West Derby.*
*Jan. 8, 1855	Brockholes, James Fitzherbert, *Puddington Old Hall, near Neston.*
Dec. 2, 1861	Browne, G. Mansfield, 15, *Fenwick-street*, and 15, *South-hill-road, Toxteth-park.*
April 21, 1862	Bulley, Samuel, *Peter's place, Rumford-street*, and *East Lodge, Prince's-park.*
April 18, 1864	Burne, Joseph, *Royal Insurance Office*, 1, *North John-street*, and *Higher Tranmere.*
Mar 9 1863	Buxton, David, F.R.S.L., Principal of the School for the Deaf and Dumb, 52, *Oxford-street.*

*May 1, 1848 Byerley, Isaac, F.L.S., F.R.C.S., *Victoria-road, Seacombe*, TREASURER.

Feb. 23, 1863 Callon, W. J., M.D., 125, *Islington*.

Nov. 3, 1862 Cameron, John, M.D., M.R.C.P., Physician to the Southern Hospital, and Lecturer on Medicine at Royal Inf. Sch. of Med., 17, *Rodney-street*.

April 7, 1862 Campbell, John, *Liverpool and London-chambers*, and *Oak House, Aigburth-hall road*.

April 7, 1862 Cawkitt, James M., *Underwriters' Room, Exchange*, and 23, *Queen's-road, Everton*.

Dec. 2, 1861 Chadburn, William, 71, *Lord street*.

Dec. 1, 1851 Clare, John Leigh, 11, *Exchange-buildings*, and *The Old Hall, Aigburth-road*.

Oct. 31, 1859 Clark, Charles, 17, *North John-st.*, and *Linden Cottage, Rock Ferry*.

Jan. 26, 1857 Clay, William, 97, *Sefton-street*, and 4, *Parkhill-road*.

May 31, 1858 Collingwood, Cuthbert M.A., M.B., Oxon, M.R.C.P., F.L.S., Lect. on Botany, Royal Infirmary Sch. of Med; Phys. to the Northern Hospital, 15, *Oxford-street*. HON. SECRETARY.

Jan. 26, 1863 Commins, Andrew, LL.D. Dub., *Clarendon-chambers*, 1, *South John-street*,

Jan. 22, 1850 Cox, Henry, 19, *Brunswick-street*, and *Poplar-rd.*, *Oxton*.

Jan. 12, 1863 Cros, Jean Baptiste, 69, *Bold-street*, and 8, *Oxford-street*.

Oct. 6, 1862 Crosfield, Wm., jun., 28, *Temple st.*, and 11A, *Rake lane*.

Feb. 8, 1864 Cuthbert, J. R., 40, *Chapel-street*, and 40, *Huskisson-st.*

Jan. 26, 1857 Dadabhai Naoroji, Professor of Gujarati, London University, 32, *Great St. Helen's*, *London*, *E.C.*

Nov. 2, 1863 Danson, J. T., *Liverpool and London-chambers*, and *Parkfield-terrace*, *Prince's-park*.

Nov. 2, 1863 Dawbarn, Wm., 4, *Chapel-street*, and 99, *Shaw-street*.

*April 6, 1840 Dickinson, Joseph, M.A, M.D. Dub., F.R.S., F.R.C.P. M.R.I.A., F.L.S., 92, *Bedford-street South*.

Nov. 27, 1848 Dove, Percy Matthew, F.S.S., 1, *North John-street*, and *Claughton*.

Nov. 27, 1863 Dove, Jno. M., *Royal Insurance Office*, and *Claughton*.

Jan. 23, 1848 Drysdale, John James, M.D., Edin., M.R.C.S., Edin. 44, *Rodney-street*.

Oct. 5, 1863 Drysdale, W. G., 7, *Elm-terrace*, *Beech-street*, *Fairfield*, and 14, *East-side Queen's Dock*.

Feb. 4, 1856	Duckworth, Henry, F.L.S., F.R.G.S., F.G.S., 5, *Cook-street*, and 2, *Gambier-terrace*.
*Nov. 27, 1848	Edwards, John Baker, Ph.D. Gies., F.C.S., Lect. on Chemistry, Liverpool Royal Infirmary Sch. of Med., *Royal Institution Laboratory*, and *Waterloo*. VICE-PRESIDENT.
Mar. 10, 1862	Ellison, Christopher O., *Adelphi-chambers*, *South John-street*, and *Esplanade*, *Waterloo*.
April 7, 1862	English, Charles J., 26, *Chapel-street*, and 26, *Falkner sq*.
Dec., 14, 1863	Erskine, Robert, 316, *Upper Parliament-street*.
Nov. 18, 1850	Evans, Henry Sudgen, F.C.S., 52, *Hanover-street*, and *Rainhill Mount*, *Rainhill*.
Feb. 24, 1862	Ewer, Harry Alexander, 21, *Harrington-street*, and *New Brighton*.
April 30, 1860	Fabert, John Otto William, 1, *Parliament.street*, and 3, *St. James's Mount*.
*Dec 13, 1852	Ferguson, William, F.L.S., F.G.S., *Liverpool and London chambers*, and 2, *St. Aidan's-terrace*, *Birkenhead*.
Feb. 9, 1863	Finlay, William, Senior Mathematical Master, Middle School, *Liverpool College*, and 49, *Everton-road*.
April 18, 1864	Fischer, Hermann, *Royal Insurance Office*.
*April 3, 1837	Fletcher, Edward, 4, *India-buildings*, and 31, *High Park-street*.
*Mar. 19, 1855	Foard, James Thomas, 5, *Essex-court*, *Temple*, *E.C.*
*Feb. 6, 1854	Gee, Robert, M.D., Heidelb. M.R.C.P., Lect. on Patholog. Anat. Royal Infirmary Sch. of Med.; Physician, Workhouse Hospital; 10, *Oxford-street*.
Feb. 9, 1863	Giles, Rev. Edward, *Huyton-park*, *Huyton*.
March 4, 1861	Ginsburg, Rev. Christian D., LL.D. Glasg., 10, *Rake-lane*. VICE-PRESIDENT.
Dec. 2, 1861	Graves, Samuel R., *Baltic-buildings*, and *The Grange*, *Wavertree*.
Oct. 5, 1863	Gray, Jno. M‘Farlane, *Vauxhall Foundry*, and 80, *Prince Edwin-street*.
Nov. 14, 1853	Greenwood, Henry, 32, *Castle-st.*, and *Roseville*, *Huyton*.
Nov. 30, 1857	Grimmer, William Henry, 15, *Cable-st.*, and 64, *Grove-st*
Jan. 22, 1855	Hakes, James, M.R.C.S., Surgeon to the Northern Hospital, *Hope-street*.
Dec. 1, 1862	Hakes, Thomas, 20, *Castle-st.*, and 47, *Dean-st.*, *Edge-lane*.
Feb. 23, 1863	Hall, Charlton R., 17, *Dale-street*, and *Liscard Castle*, *Liscard*.

*Jan. 21, 1856	Hardman, Lawrence, 5, *India-buildings*, and *Rock-park, Rock Ferry*.
Feb. 9, 1863	Hart, Thos. Aubrey, M.A. Oxon, 81, *Bedford-st., South*.
Jan. 13, 1862	Harvey, Enoch, 12, *Castle-street*, and *Greenheys, Riversdale-road, Aigburth*.
April 27, 1862	Hausburg, Friedrich Leopold Ludwig, *Rosenfels, Woolton*.
*Mar. 7, 1842	Heath, Edward, *Orange-court*, 37, *Castle-street*, and *St. Domingo-grove*, 114, *Breckfield-road N., Everton*.
Dec. 12, 1855	Hess, Ralph, *Albany, Oldhall-street*, and 17, *Upper Duke-street*.
Dec. 28, 1846	Higgins, Rev. H. H., M.A., Cantab., F.C.P.S., *Rainhill*.
*Oct. 31, 1836	Higginson, Alfred, M.R.C.S., Surg. Southern Hosp., 44, *Upper Parliament-street*.
Mar. 4, 1861	Hindley, Rev. H. J., M.A., 3, *Grecian-terrace, Everton*.
Nov. 16, 1863	Holden, Adam, 48, *Church-street*, and 5, *Towerlands-street, Edge Hill*.
Nov. 13, 1854	Holland, Charles, *Liscard-vale, New Brighton*.
*Dec. 14, 1862	Holt, Robert Durning, 6, *India-buildings*, and 2, *Rake-lane*.
Mar. 22, 1847	Horner, Henry P., 2, *Derby-square*, and 5, *Devonshire-road, Prince's park*.
Nov. 4, 1850	Howson, Rev. John Saul, D.D. Trin. Col. Cantab., Principal of the Liverpool College, *Shaw-street*, and *Dingle-park, Dingle lane*.
Dec. 27, 1841	Hume, Rev. Abrah., D.C.L. Dub., LL.D. Glas., F.S.A., 24, *Clarence-street, Everton*.
*Nov. 13, 1854	Hunter, John, Memb. Hist. Soc. Pennsylvania, *Halifax, Nova Scotia*.
Jan. 13, 1862	Hutchison, Robert, *Barned-buildings, Sweeting-street*, and 6, *Canning-street*.
Jan. 26, 1857	Hutton, David, 3, *St. George's-crescent*, and 61, *Canning-street*.
*Apr. 29, 1850	Ihne, William, Ph.D. Bonn, *Villa Felseck, Heidelberg*.
Feb. 23. 1867	Imlach, Henry, M.D. Edin., 1, *Abercromby-square*.
*Oct. 21, 1844	Inman, Thomas, M.D. London, M.R.C.P., Phys. Royal Infirmary, 12, *Rodney-street*, and *Spital, Cheshire*.
Mar. 10, 1862	Johnson, Richard, *Queen Insurance-buildings*, and *Brookfield House, Seaforth*.
Jan. 26, 1863	Johnson, Richard, jun., *Queen Insurance-buildings*.

Jan. 23, 1854	Jones, John, 28, *Chapel-street*, and 70, *Rodney-street.*
Mar. 9, 1863	Jones, Rev. Joshua, M.A. Oxon, Principal of the Liverpool Institute, 59, *Bedford-street South.*
*April 4, 1852	Jones, Morris Charles, *Queen Insurance-buildings*, and 75, *Shaw-street.*
Mar. 23, 1863	Jones, R. D., B.A., T.C.D., *Collegiate Institution.*
May 5, 1851	Jones, Roger Lyon, *Liverpool and London-chambers*, *Exchange*, and 6, *Sunnyside*, *Prince's-park.*
Feb. 19, 1855	King, Alfred, 14, *Newington*, and 9, *Netherfield rd. South.*
Jan. 10, 1848	Lamport, William James, 21, *Water-street*, and 5, *Beech-terrace*, *Beech-street*, *Fairfield.*
*Jan. 14, 1839	Lassell, William, F.R.SS.L. and E., F.R.A.S. 27, *Milton-street*, and *Broadstones*, *Sandfield-park*, *West Derby.*
April 27, 1862	Lassell, William, jun., 27, *Milton-street*, and *Tue Brook.*
Oct. 21, 1844	Lear, John, 1, *North John-st.*, and 22, *Holland-terrace*, *Duke-street*, *Edge Hill.*
Feb 10, 1862	Leycester, Edmund Mortimore, Commander R.N., *Admiralty Office*, 2, *Drury-lane*, and 20, *Belvedere-road*, *Prince's-park.*
Dec. 10, 1860	Leyland, Joseph, *Williamson-square.*
Feb. 9, 1863	Lister, Edward, L.R.C.P.E., 6, *Beech-street*, *Fairfield.*
May 4, 1863	Lister, James, *Union Bank*, 6, *Brunswick-street*, and *Greenbank*, 166, *Breckfield-road North.*
Feb. 9, 1863	Loraine, Rev. Nevison, M.A., 1, *The Willows*, *Breck-road.*
Oct. 20, 1859	M'Andrew, James Johnston, 5, *North John-street*, and *Greenfield Cottage*, *Bromborough.*
*Oct. 21, 1844	M'Andrew, Robert, F.R.S., F.L.S., *Isleworth House*, *Isleworth*, *London.*
March 9, 1857	MacFie, Robert Andrew, 30, *Moorfields*, and *Ashfield Hall*, *Neston*, *Cheshire.*
April 20, 1863	Marples, David, 50B *Lord-street*, and 108, *Chatham-st.*
Jan. 21, 1839	Martin, Studley, 30, *Exchange*, and 109, *Bedford-st.*
Feb. 5, 1844	Mayer, Joseph, F.S.A., F.R.A.S., F.E.S., 68, *Lord-street.*
Jan. 12, 1863	Mellor, Rev. Enoch, M.A., 15, *Devonshire-road*, *Prince's-park.*
April 1, 1861	Melly, George, 7, *Water-street*, and 90, *Chatham-street.*
Oct. 31, 1859	Moore, Thomas John, Corr. Mem. Z.S., Curator Free Public Museum, *William Brown-street.*
Jan. 8, 1855	Morton, George Highfield, F.G.S., 9, *London-road.*
April 16, 1849	Moss, Rev. John James, B.A., *Upton*, *Cheshire.*

Oct. 29, 1850 Mott, Albert Julius, 19, *South Castle-street*, and *Holt-hill.*

April 3, 1854 Mott, Charles Grey, 27, *Argyle-street*, *Birkenhead*, and 2, *Shewell's-road*, *Holt-hill.*

Oct. 20, 1856 Nevins, John Birkbeck, M D., Lond., M.R.C.S., Lect. on Materia Medica, Roy. Infirmary School of Medicine, 25, *Oxford-street*, VICE-PRESIDENT.

April 7, 1862 Newlands, Alexander, 6, *Rumford-place*, and 13, *Canning-street.*

Dec. 15, 1851 Newlands, James, F.R.S.S.A., Borough Engineer, 2, *Cornwallis-st.*, and *Elm Farm*, *Fairfield.*

*Nov. 29, 1847 Nisbet, William, L.F.P.S.G., *Church-street*, *Egremont.*

*Oct. 15, 1855 North Alfred, *Salcombe-hill*, *Sidmouth*, *Devonshire.*

Nov. 18, 1861 Nugent, Rev. James, *Crosby.*

Mar. 23, 1863 Page, Rev. George C., LL.D., *Gambier House*, *Fairfield.*

Nov. 4, 1861 Philip, Thomas D., 49, *South Castle-street*, and 47, *Prospect-vale*, *Fairfield.*

Dec. 28, 1846 Picton, James Allanson, F.S.A., Chairman of the Library and Museum Committee, 11, *Dale-street*, and *Sandy-knowe*, *Wavertree.* PRESIDENT.

Feb. 6, 1854 Prange, F., *Royal Bank-buildings*, *Dale-street*, and 2, *Grove-park*, *Lodge-lane.*

April 7, 1862 Rankin, Robert, Chairman of the Dock Board, 55, *South John-street*, and *Brombro' Hall*, *Cheshire.*

†Mar. 13, 1812 Rathbone, William, 20, *Water-street* and *Greenbank*, *Wavertree.*

Nov. 12, 1860 Rathbone, Philip H., 4, *Water-street*, and *Greenbank-cottage*, *Wavertree.*

Mar. 24, 1862 Rathbone, Richard Reynolds, 21, *Water-street*, and *Laurel Bank*, *St. Michael's-road.*

*Jan. 7, 1856 Rawlins, Charles Edward, Jun., 23, *Cable-street*, and 1, *Windermere-terrace*, *Prince's-park.*

*Nov. 17, 1851 Redish, Joseph Carter, 18, *Chapel-street*, and 19, *Hope-street.*

Nov. 2, 1840 Robberds, Rev. John, B.A., 58, *High Park-street.*

Jan. 25, 1864 Roberts, F. T., M.B., B.Sc., Lond., M.R.C.S., *Northern Hospital.*

Feb. 10, 1862 Rogers, Thomas Law, M.D., M.R.C.P., Superintendent, *County Asylum*, *Rainhill.*

Feb. 9, 1863 Ronald, Lionel K., 19, *Dale-st.*, & *Elm House*, *Edge-lane.*

April 18, 1854 Rowe, James, 2, *Chapel-walks*, and 51, *Shaw-street.*

April 7, 1862	Samuel, Harry S., 2, *Canning-street.*
Jan. 11, 1864	Samuelson, James, 18, *Dale-street*, and 8, *Jubilee-street, Everton.*
April 6, 1846	Scholfield, Henry Daniel, M.D., Oxon., M.R.C.S., 14, *Hamilton-square, Birkenhead.*
Nov. 16, 1863	Sheldon, E. M., 256, *Vauxhall-road.*
Nov. 2, 1863	Skillicorn, John E., *Whitley-terrace*, 206, *Walton-road.*
Nov. 7, 1864	Skinner, Thomas, M.D. Edin., 1, *St. James'-road.*
*April 21, 1862	Smith, James, *Barkeley House, Seaforth.*
†Mar. 13, 1812	Smith, James Houlbroke, 28, *Rodney-street*, and *Green-hill, Allerton.*
Feb, 23, 1863	Smith, J. Simm, *Royal Insurance Office, Dale-street.*
Feb. 24, 1862	Snape, Joseph, Lecturer on Dental Surgery, Royal Infirmary School of Medicine, 75, *Rodney street.*
Nov. 12, 1860	Spence, Charles, 4, *Oldhall-street*, and 21, *Catherine-street.*
Feb. 10, 1862	Spence, James, 5, *Fenwick-street*, and 54, *Upper Parliament-street.*
Dec. 14, 1857	Steele, Robert Topham, 4, *Water-street*, and 8, *Bedford-street South.*
Dec. 2, 1861	Steinthal, Rev. Samuel Alfred, 59, *Rodney-street.*
May 2, 1864	Stitt, John Johnson, 17, *Water-street* and *Elm House, Anfield.*
Oct. 18, 1858	Stuart, Richard, 10, *Exchange-street East*, and *Brooklyn Villa, Breeze-hill, Walton.*
*Feb. 19, 1855	Taylor, John Stopford, M.D. Aberd., F.R.G.S., 1, *Springfield, St. Anne-street.*
Jan. 23, 1843	Taylor, Robert Hibbert, M.D., Edin., L.R.C.S., Ed., Lect. on Ophthalmic Medicine, Royal Infirmary School of Medicine, 1, *Percy-street.*
Dec. 11, 1854	Thompson, Samuel H., *Thingwall Hall, Knotty Ash.*
Nov. 17, 1856	Tinling, Chas., 60, *Castle-street*, and *Bedford-terrace*, 48, *Low-hill.*
Nov. 26, 1860	Tooke, William H., *Church-street*, and *Wellington-street, Waterloo.*
Dec. 1, 1851	Towson, John Thomas, F.R.G.S., Scientific Examiner, Sailors' Home, 47, *Upper Parliament street.*
*Feb. 19, 1844	Turnbull, James Muter, M.D., Edin., M.R.C.P., Phys. Royal Infirmary, 86, *Rodney-street.*
Oct. 21, 1861	Unwin, William Andrew, 11, *Rumford-place*, and *Newbie-terrace.*

Oct. 21, 1844 Vose, James Richard White, M.D., Edin., F.R.C.P., Phys. Royal Infirmary, 5, *Gambier-terrace.*

Mar. 18, 1861 Walker, Thomas Shadford, M.R.C.S., 54, *Rodney-street.*

Jan. 27, 1862 Walmsley, Gilbert G., 50, *Lord-street.*

Feb. 10, 1862 Weightman, John Hardham, 57, *Ranelagh-street*, and 27, *Baker-street, Low-hill.*

Dec. 2, 1861 Weightman, William Henry, *Leith Offices, Moorfields*, and *Hapsford-lane, Litherland.*

Jan. 26, 1863 Whitelaw, George, *Collegiate Institution.*

April 7, 1862 Whittle, Ewing, M.D., Lecturer on Med. Jurisprudence Royal Inf. Sch. of Med., 65, *Catherine-street.*

Nov. 2, 1863 Whitty, W. Alfred, "*Daily Post*" *Office*, and 8, *Catharine-street.*

Oct. 29, 1855 Wilks, William George, 1, *Dale-st.* and *Mill-bank, Anfield.*

April 7, 1862 Willans, Thomas H., 82, *Rodney street.*

Nov. 18, 1861 Williams, Charles Wye, A.I.C.E., *The Nook, St. James's Mount.*

Mar. 18, 1861 Wood, Geo. S., *Belle-vue-road, Wavertree*, and 20, *Lord-st.*

Feb. 9, 1863 Wood, John W., 81, *Church-street.*

Dec. 14, 1863 Zwilchenbart, Rodolph, Jun., *Queen Insurance Buildings*, and 26, *Bedford-street South.*

HONORARY MEMBERS.

LIMITED TO FIFTY.

1812 Peter Mark Roget, M.D., Edin., F.R.C.P., F.R.S., F.G.S., F.R.A.S., F.R.G.S., &c., 18, *Upper Bedford-place, London.*

1819 John Stanley, M.D., Edin., *Whitehaven.*

1827 Rev. William Hincks, F.R.S.E., F.L.S., Professor of Natural History in Unversity College, *Toronto, C.W.*

1828 Rev. Brook Aspland, *Dukinfield, Cheshire.*

1833 The Right Hon. Dudley Ryder, Earl of Harrowby, K.G., D.C.L., F.R.S. *Sandon-hall, Staffordshire*, & 39, *Grosvenor-square, London, W.*

1833 James Yates, M.A., F.R.S., F.L.S., F.G.S., &c., *Lauderdale House, Highgate, London.*

1835 George Patten, A.R.A., 21, *Queen's-road West, Regent's-park, London.*

1835 William Ewart, M.P., *Cambridge-square, Hyde-park, London.*

1835 The Right Hon. Lord Brougham and Vaux, M.A., D.C.L., F.R.S., Chancellor of the University of Edinburgh, 4, *Grafton-street, London, W.*, and *Brougham Hall, Penrith.*
1837 The Most Noble William, Duke of Devonshire, K.G., M.A., F.R.S., F.G.S., &c., Chancellor of the Univer. of Cambridge, *Devonshire House, London, W.*, and *Chatsworth, Derbyshire.*
1838 George Biddell Airy, M.A., D.C.L., F.R.S., Hon. F.R.S.E., Hon. M.R.I.A., V.P.R.A.S., F.C.P.S., &c., Astronomer Royal, *Royal Observatory, Greenwich.*
1840 James Nasmyth, F.R.A.S., *Penshurst, Kent.*
1840 Richard Duncan Mackintosh, L.R.C.P., *Exeter.*
1841 Charles Bryce, M.D., Glasg., Fell.F.P.S.G., *Brighton.*
1844 J. Beete Jukes, M.A., F.R.S., M.R.I.A., F.G.S., Local Director of the Geological Survey of Ireland, 51, *Stephen's-green, Dublin.*
1844 T. P. Hall, *Coggeshall, Essex.*
1844 Peter Rylands, *Warrington.*
1844 John Scouler, M.D., LL.D., F.L.S., *Glasgow.*
1844 Thomas Rymer Jones, F.R.S., F.Z.S., F.L.S., Professor of Comparative Anatomy, *King's College, London.*
1844 Robert Patterson, F.R.S., M.R.I.A., *Belfast.*
1844 Sir Charles Lemon, Bart., M.A., Cantab., F.R.S., F.G.S., *Penrhyn, Cornwall.*
1844 William Carpenter, M.D., Edin., F.R.S., F.L S. F.G.S., *Registrar, London University.*
1847 Sir William Rowan Hamilton, LL.D., Hon. F.R.S.E., M.R.I.A., F.R.A.S., F.C.P.S., Astronomer Royal for Ireland, *Dublin.*
1848 Rev. Thomas Corser, M.A., *Strand, Bury.*
1850 Rev. St. Vincent Beechy, M.A., Cantab., *Worsley, near Eccles.*
1851 James Smith, F.R.SS.L. and E., F.G.S., F.R.G.S., *Jordan-hill, Glasgow.*
1851 Henry Clarke Pidgeon, *London.*
1851 Rev. Robert Bickersteth Mayor, M.A., Fell. St. John's Coll. Cantab., F.C.P.S., *Rugby.*
1852 William Reynolds, M.D., *Coed-du, Denbighshire.*
1853 Rev. James Booth, LL.D, F.R.S., &c., *Stone, near Aylesbury.*

1857 Thomas Jos. Hutchinson, F.R.G.S., F.R.S.L., F.E.S., H.B.M. Consul, *Rosario*.

1861 Louis Agassiz, Professor of Natural History in Harvard Unversity, *Cambridge, Massachussets.*

1861 William Fairbairn, LL.D., C.E., F.R.S., *Polygon, near Manchester.*

1861 Rev. Thomas P. Kirkman, M.A., F.R.S., *Croft Rectory, Warrington.*

1862 The Right Rev. H. N. Staley, D.D., Bishop of Honolulu, *Sandwich Islands.*

1863 Edward J. Reed, Chief Constructor of H.M. Navy, *Admiralty*, and *Hyde Vale, Greenwich, S.E.*

ASSOCIATES.

LIMITED TO TWENTY-FIVE.

Dec. 2, 1861 Captain James Anderson, R.M.S.S., "China," Cunard Service, 34, *Richmond-terrace, Everton.* (Atlantic.)

Jan. 27, 1862 Captain John H. Mortimer, ship "America." (Atlantic.)

Mar. 24, 1862 Captain P. C. Petrie, "City of London," Commodore of the Inman Line of American Steam Packets. (Atlantic.)

Feb. 9, 1863 Captain James P. Anderson, First Officer R.M.S.S. "China," Cunard service, *Commercial Hotel, Dale-st.* (Atlantic.)

Feb. 9, 1863 Captain John Carr (Bushby & Edwards) ship "Scindia," 43, *Hope-street.* (Calcutta.)

Feb. 9, 1863 Captain Charles E. Price, R. N. R. (L. Young and Co.) ship "Cornwallis" (Calcutta and Sydney.)

April 20, 1863 Captain Fred. E. Baker, ship "Niphon." (Chinese Seas.)

TREASURER'S ACCOUNTS, 1862-63.

Dr. *Literary and Philosophical Society in account with* Isaac Byerley, *Treasurer, to October*, 1863. **Cr.**

Dr.	£	s.	d.
To paid Brakell for printing "Proceedings"	84	9	6
" Tinling for printing	14	12	1
" Secretary's expenses of management, distribution of circulars and Proceedings, miscellaneous correspondence, parcels, messengers, incidentals	19	17	6
" Account for wood-cuts	1	5	0
" Miscellanies	0	12	0
" Secretary's Editorial fee	10	10	0
" Mrs. Johnson for tea, coffee, &c.	14	5	8
" Waiter's attendance	1	17	6
" Collector's commission	6	9	0
	153	18	3
To Balance carried down	225	7	5
	£379	5	8

Errors excepted.

Audited and found correct,

ARNOLD BARUCHSON.

J. C. REDISH.

Cr.	£	s.	d.
By Balance from last account	199	11	10
" 128 Members' Subscriptions, at 21/ each	134	8	0
" 9 ditto ditto, at 10/6 each	4	14	6
" Arrears	8	8	0
" 33 Entrance fees	17	6	6
" 1 Life-Member's fee	10	10	0
" Interest on Dock bond	4	6	10
	£379	5	8

	£	s.	d.
Dock bonds	£200	0	0
Cash in bank	5	3	10
Do. in Treasurer's hand	20	3	7
	£225	7	5

PROCEEDINGS

OF THE

LIVERPOOL

LITERARY AND PHILOSOPHICAL SOCIETY.

ANNUAL MEETING.—FIFTY-THIRD SESSION.

ROYAL INSTITUTION, October 5th, 1863.

The REV. J. ROBBERDS, B.A., V.P., in the Chair.

The minutes of the last meeting having been confirmed,

The SECRETARY read the following

REPORT.

The Literary and Philosophical Society still continues to maintain the prosperous and flourishing attitude which it has assumed of late, and which was a source of such just congratulation in the last annual Report. It has now fairly entered upon the second half-century of its existence, and there seems no reason to doubt that it is destined to occupy a more conspicuous place than it has ever hitherto done in the literary and scientific history of the town. There have not, perhaps, occurred so many topics of interest during the last year as in the previous one; but although the Report of the Council may not be so remarkable or so eventful, it has nevertheless to tell of a steady advance, and an increasing appreciation of the objects aimed at by the Society.

The accessions to the Society during the past year have been sufficiently numerous to render its stability a matter of no anxiety or doubt. Thirty-four new members have been enrolled, which, added to the thirty-nine elections of the previous year, produce the unprecedented total of seventy-three ordinary members elected during two consecutive sessions. The widening interest indicated by this fact is an important sign, independently of the impulse thus given to the Society through its finances, for the new members thus elected represent an additional sum of £48 6s. wherewith to meet last year's expenses, as well as a permanent addition of thirty-four guineas to our funds.

The Treasurer's statement, which will be presently submitted to you, will, as may be anticipated, show a very satisfactory condition of the Society's exchequer, and a vast improvement upon the position it exhibited three years since. The income of the past year, from all sources, has been little short of £200, a sum amply sufficient to carry on the ordinary expenditure of the Society without stint; whilst the reserve fund of £200 has been invested in a dock bond in the names of the Treasurer and Secretary, and thus amply secures the Society against any unforeseen accidents.

One honorary member and five associates have also been added to our list; but against all these accessions we must place the loss of fourteen ordinary members by *resignation* from various causes, and one by *death*. Among the former was an active member of our Council and contributor to our Proceedings, the loss of whom we much regret—Dr. David Walker, who quitted Liverpool last winter on a scientific mission to a distant part of the world.

The present numerical position of the Society is as follows: There were on the list at the end of last session 165 ordinary members; at the present time it includes 184 ordinary members, of whom 27 are life members, the number of actual subscribers being therefore 157. To these, if we add 39 honorary members and 8 associates, our total numbers appear to be 231.

Only one member has been removed by death during the past year, but that member has been identified with the Society in a remarkable manner, although latterly he did not often appear amongst us. This was Dr. Duncan, the late medical officer of health for the borough, whose paper "On the physical causes of the high rate of mortality in Liverpool," read before the Society in February and March, 1843, and afterwards published, was the means of calling attention to sanitary questions in so prominent a manner, that to it may be distinctly traced the movement which resulted in the passing of that most important act of Parliament usually known as the "Health of towns bill." Dr. Duncan was for more than a quarter of a century a member of the Society, and formerly a very active one, having for several years filled the important post of Treasurer. Of late years, failing health greatly impaired his natural activity, and having visited Scotland in the spring with the hope of benefiting his constitution, he expired suddenly at Elgin, in May last.

Although, however, happily, neither by resignation nor by death, we have yet lost from among us a gentleman whose place it will be difficult to fill, by the retirement to his native country of Dr. Ihne, the president of the Society. A member of the Society for 13 years, Dr. Ihne has ever taken an active interest in its progress and usefulness, and has from time to time contributed, from his stores of classical and philological learning, papers of the greatest interest and value. Few scholars possess a wider, and withal a sounder, knowledge of the branches of literature he specially cultivated, and his departure will be felt by the Society as no less involving the loss of a profound scholar than of a true-hearted gentleman. Dr. Ihne has several times occupied the position of vice-president, and at the last annual meeting, he was unanimously elected to the rank of President. Instead, however, of filling the chair for three years, he has, to our regret, been obliged to resign it at the end of the first session, and is now settled on the banks of the Neckar, and in the classical atmosphere of Heidelberg, whither the best wishes of the Society follow him.

The retirement of Dr. Ihne leaves the presidential chair vacant, and you will be called upon this evening to exercise your votes in the election of a worthy successor from the general body of the Society.

The volume of Proceedings for the past session is nearly ready, and will shortly be in the hands of the members. Though not quite so large as those of recent years, the matter will be found no less varied than instructive. From various circumstances only half the papers read during the session have been printed entire—a proportion which is somewhat smaller than usual.

The Society's library continues to be increased, and more especially by transactions of foreign societies, which are often difficult of access. It is hoped that before the end of the year the obstacles which have hitherto intervened may be removed, and the promised bookcases may be constructed. When that has been accomplished there will be no further delay in the cataloguing of the books, the completion of series, and the general availability of the library to the members at large.

The delegates from the Society to aid in the management of the Gallery of Inventions and Science have to make a more favorable report than heretofore. The gallery has been furnished by the aid of liberal subscriptions, and was opened to the public on the occasion of the marriage of the Prince of Wales, 10th March last. It now contains a large number of interesting models and inventions which have been deposited by the owners or patentees, and form a very interesting collection. The Committee are of opinion that it only requires to be more widely known among inventors to cause it to become a very valuable and useful institution; and this they hope that time will gradually effect.

The only important change in the conduct of the Society, made during the last session, was the passing of a bye-law, providing for the admission of ladies to the meetings on certain occasions, to be fixed upon by the Council. This plan has been tried, and found to operate very successfully. During the session four meetings were held at which the papers were of sufficient general interest to warrant the Council in inviting ladies. An average attendance of upwards of twenty-five ladies was the result, besides a considerably increased number of members and friends. The publicity thus given to the Society and its objects appears to warrant the continuance of the custom, and abundantly to counterbalance the small additional expenditure involved in providing refreshments for the increased numbers.

The annual dinner of the Society was held at Rock Ferry in the latter part of May, and although, owing to unfortunate weather, the attendance was not large, sufficient encouragement was given as to lead the Council to believe that such social meetings of the members of the Society are highly desirable.

It is desired to draw the attention of the Society to the forthcoming tercentenary anniversary of the birth of our great national poet and dramatist, William Shakspere, which will occur on the 23rd April, 1864. Such an interesting event is being naturally seized upon by the *literati* of all classes and all tenets, and the National Shakspere Committee now includes nearly every man of eminence in the literary world. Moreover, branch committees are being formed in all the principal towns, and the Council would wish the members of the Society to combine in some way, to be hereafter deliberated upon, in order that Liverpool may not be wanting in its homage to the genius which has ennobled the national character, and through it the whole human race.

The number of papers promised for the forthcoming session leads to the hope that there may be ample material for discussion at the meetings, and also that the Proceedings will experience no decline in interest or usefulness. At the same time your Council wish to impress upon the members of this Society the importance of keeping up the standard of the papers which go forth to the literary and scientific world as the product of the session's work. Nor is it sufficient that the standard be merely maintained as a stationary one,—it is necessary that it should be advanced and improved each year, if we would keep pace with other publishing Societies, and maintain a position worthy of the enterprise and intelligence of the town whose science and literature we represent. The Council especially invite brief communications upon subjects of original research, feeling assured that the interest of the meetings and the durability of the published papers alike depend upon the originality and freshness of the matter brought before the Society.

In conclusion, and in compliance with Law 36, the retiring Council recommend the five following gentlemen for election upon the Council for the ensuing year, viz.:—Dr. J. B. Edwards, F.C.S.; Mr. J. T. Towson, F.R.G.S.; Mr. Chas. Edwd. Rawlins, jun.; Mr. James Birch, and Mr. S. H. Behrend, M.A.

(Signed)

J. ROBBERDS, V.P.
CUTHBERT COLLINGWOOD, Hon. Sec.

It was moved by Mr. HIGGINSON, and seconded by Dr. HIBBERT TAYLOR—"That the Report now read be adopted, and that the portion relating to the late Dr. Duncan be extracted, and sent, with the regretful remembrances of the Society, to his widow."

The TREASURER then presented his accounts, audited by Mr. Baruchson and Mr. Redish.

Moved by Mr. REDISH, seconded by Rev. W. BANISTER, and carried—"That the accounts now presented be passed."

The following office-bearers were then elected:—

President (for three years):
JAMES A. PICTON, F.S.A.

Vice-Presidents:
J. BIRKBECK NEVINS, M.D.
REV. C. D. GINSBURG, LL.D.
J. BAKER EDWARDS, Ph.D., F.C.S.

Treasurer:
ISAAC BYERLEY, F.R.C.S., F.L.S.

Hon. Secretary:
CUTHBERT COLLINGWOOD, M.A. and M.B. (Oxon), F.L.S., &c.

The following gentlemen were also elected members of the Council:—

Rev. J. Robberds, J. C. Redish, Alfred Higginson, Rev. H. H. Higgins, Arnold Baruchson, J. T. Towson, Charles E. Rawlins, jun., James Birch, and S. H. Behrend, M.A.

Messrs. W. G. Drysdale and J. M'Farlane Gray were balloted for, and duly elected ordinary members of the Society.

The following gentlemen were elected to act as delegates from the Society to act on the Committee for the Management of the Gallery of Inventions:—Mr. A. Higginson, the Rev. Dr. Ginsburg, the Rev. J. Robberds, Dr. Nevins, and Dr. Collingwood.

The consideration of the approaching Shakspere Tercentenary, which was to have been discussed at this meeting, was postponed for want of time.

FIRST ORDINARY MEETING.

Royal Institution, October 19th, 1863.

J. BIRKBECK NEVINS, M.D., V.P., in the Chair.

It was announced from the Council that the Secretary had been requested to communicate with the Central National Shakspeare Committee, in order to learn how the Society could best co-operate with them in the celebration of the forthcoming tercentenary festival.

The Rev. Joshua Jones, M.A., was elected upon the Council in the place of Mr. C. E. Rawlins, jun., resigned.

Captains James Anderson, Mortimer, P. C. Petrie, J. P. Anderson, C. E. Pryce, John Carr, and F. E. Baker, were re-elected Associates, on the recommendation of the Council.

Dr. Edwards drew the attention of the members to some new forms of Geissler's vacua tubes, which exhibited the electric discharge by induction, producing two negative poles, one at each terminal, illustrating the peculiar disposition of the force in certain bar magnets, which exhibited poles of similar polarity at either end. He also showed a new form of throat tube, for surgical operations by aid of the electric light; and a form of "miner's lamp" illuminated from the same source.

Mr. Turner exhibited some remarkable sheets of a substance having the appearance of tissue paper, which were found at the bottom of a biscuit chest by Captain Morison. There were abundance of grubs; and Mr. Byerley and Dr. Collingwood having examined it by the microscope, gave their opinion that it was of insect origin. The substance caused great interest among the members, and various opinions were given as to the possibility of its production by insects.

A paper was then read by the Rev. Dr. Ginsburg, on

"THE KABBALAH."*

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* This paper will be found at the latter part of the present volume.

SECOND ORDINARY MEETING.

ROYAL INSTITUTION, 2nd November, 1863.

The Rev. C. D. GINSBURG, LL.D., V.P., in the Chair.

The Council had invited ladies to the meeting, which was very largely attended.

The following gentlemen were balloted for, and duly elected members of the society :—

Messrs. J. T. Danson, J. M. Dove, Wm. Dawbarn, Wm. Alfred Whitty, Jno. E. Skillicorn and A. Billson.

The Rev. H. H. Higgins and Mr. J. T. Towson made some observations upon the formation of hail.

The following communication was read from Professor Elliot :—

" The following interesting fact is too important to be lost sight of, especially as it may soon be covered up from view, and as no geologist as yet appears to have noticed it :—

" In a direct line with Windsor street the open valley is crossed by a long mound of mouldering sandstone, carted from the new railway cutting. The mound is crossed at its south end by a cart road. Turning eastward along that, at about seventy yards from the mound, you see a hollow from which the earth has been taken to make bricks, and in the hollow two smooth platforms of altogether about a quarter of an acre in extent, or somewhat less. Looking down upon it you see numerous streaks, perfectly straight and parallel, running, I think, nearly north and south, by the compass. These you take at first to be marks left by removed rows of bricks. On going nearer, however, you find that the platform is of cleared rock, and that the marks are cut in the rock itself. Your next impression is that they are the edges of numerous thin strata, 'cropping out' on the surface. But their perfect straightness precludes that supposition, unless the strata had been nearly vertical, which they have no chance to be there. If you examine them more closely you will find that they have no cracks or other continuations below the surface; that they have no differences of colour; that they do not coincide with any line of stratification, unless in one instance for a short way, soon leaving it, and not turned by it an inch out of their straight direction; and that they are, in fact, grooves ploughed in the solid rock, which has been previously planed smooth. They are undoubtedly markings of that kind attributed now by geologists to glaciers and icebergs, whether correctly or not I do not pretend to say. Whether or not, they are the finest specimens of that kind which I have ever seen; and I think it right to draw attention to them before the ruthless brickmakers, who care for none of these things, immerse them in water or cover them up again with earth; and I invite all who have any doubt of my testimony to go and see for themselves.

"I may add that, in the detached portion to the northwest, the same markings continue equally numerous, straight, and parallel, and in the same line with the others, and it is not improbable that they extend below the soil over the whole of the Parliament-fields, judging from their remarkable flatness. In the detached portion there are a few other grooves, also perfectly straight and parallel, but crossing the former at an angle of about 45 degrees. There are also numerous short marks, as if made with picks, cutting the first-mentioned at a uniform angle of about 85 degrees. It is scarcely possible that they can be pickmarks. The *principal* lines are *assuredly* not artificial, but, whatever their origin, have been cut by some hard substances sliding along under tremendous pressure."

A paper was then read (illustrated by numerous experiments) on the following subject:—

THE WORLD AS IT MIGHT HAVE BEEN;

OR, THE JEWISH AND HEATHEN COSMOGONIES CONTRASTED BY THE LIGHT OF MODERN SCIENCE.

By J. BIRKBECK NEVINS, M.D. Lond., V.P.

THIRD ORDINARY MEETING.

Royal Institution, November 16th, 1863.

JAMES A. PICTON, Esq., F.S.A., President, in the Chair.

Messrs. E. M. Sheldon and Adam Holden were balloted for, and duly elected members.

A further communication was read from Professor Elliot relative to the supposed glacier markings in Parliament-fields, as follows:—

"I have since discovered a continuation of the same grooved surface in three places near each other, from 20 or 30 to somewhere about 100 yards to the northeast of the principal place, and, in fact, wherever you can see the surface of the rock below the brick earth. The markings in these places are by no means faint, but even more deeply cut than the first, and go so far to confirm my conjecture that probably the whole level tract, of which the Parliament-fields form a part, is a table planed flat by Nature's grand planing or ploughing machine, whatever it was.

"In writing the previous letter I was not aware that Mr. Morton had previously discovered and described other similar impressions in the neighbourhood of Liverpool. But no matter, this is one added to the number, and that on a very grand scale, and very conveniently situated for further observation."

Mr. A. HIGGINSON exhibited a rubbing of one of these markings, showing well their general character, and made some observations upon the general question, based upon an inspection of the spot.

Mr. MORTON said he had traced glacier markings in six different places round Liverpool.

The PRESIDENT and Mr. NISBET having made some further remarks, the subject was dropped.

Dr. COLLINGWOOD called attention to a report of the meeting of the Entomological Society, in the ***Athenæum***, relative to the web exhibited at a former meeting of this society, as follows:—" Professor Westwood exhibited a large sheet of delicate white silky matter, like tissue paper, but extremely soft and smooth like the very finest kid; it had been sent to him by Dr. Collingwood, and was taken from the bottom of a biscuit-chest, the buscuits themselves having been attacked by larvæ, which were described as dipterous in appearance. It was thought, however, that the larvæ were lepidopterous, and that the silky web was the work of *Tinea granella*.

The President, James A. Picton, Esq., F.S.A., on taking the chair for the first time, read the following

INAUGURAL ADDRESS.

Gentlemen,

I have to thank you most sincerely for the honour you have conferred upon me in electing me to the office of President of the Literary and Philosophical Society. The chair which has been filled by Roscoe, Traill, and Yates, and since by many men of eminence still living, is a position which any one may well feel proud to occupy. Whatever may be my shortcomings, I can assure you that I bring with me a sincere and earnest desire to discharge the duties of the office in a satisfactory manner, and I trust to your kindness and good feeling to extenuate any involuntary deficiencies.

The history of this society has been so well elucidated on the recent occasion of its jubilee, that it would be superfluous in me to make any special reference to it on the present occasion, but there are certain aspects connected with its past history and present position to which it may be desirable to call your attention.

When the Literary and Philosophical Society was established about fifty-two years since, it was, I believe, the only one of its kind in the town, and was intended to embrace the whole circle of intellectual and scientific pursuits. At that period, when the population of the town was not more than one-fifth of the present, it could not be expected that there would be scope for the establishment of societies devoted to distinct and special studies, whether of literature, science, or art. It was, therefore, a wise and prudent step which was taken by the founders in giving to it as extensive and catholic a character as possible, and the success which attended its operations during so many years is the best justification of the course. Time, however, brings with it its usual changes; the fertilising stream of one age, if neglected, becomes the stagnant pool of the next. All institutions require perpetual adaptation to the changing aspects of the times; or it may rather be said that the progress of events insensibly and necessarily moulds institutions according to the requirements of the day.

The great and manifold advantages of a society devoting itself exclusively to one particular science or pursuit are so obvious that it cannot be surprising that gradually there have grown into existence societies of this class. There is a certain ***esprit du corps***, a common feeling, where the subjects are limited, and all the ideas, as it were, radiate from a common centre, which makes a society of this kind very attractive. Accordingly, we have witnessed the establishment of the Chemical, the Architectural and Archæological, the Polytechnic, the Geological, the Social Science, and, although more catholic in the sphere of its action, the Historic, Societies. These, all in their several departments, have done good service to the cause of science and literature, and we sincerely wish them to go on and prosper.

It may then be asked, if each department has its own representative society, labouring in its vocation with diligence and zeal, what remains for the Literary and Philosophical Society? Has it not answered its purpose in its day, and would it not be well to retire with dignity, and leave the field open to the special votaries of each particular science? I wish to present a few reasons why, as it appears to me, not only would this be unadvisable, but that in the course which science and literature appear to be taking, societies occupying the extensive platform laid down by the Literary and Philosophical, are more than ever required.

As the boundaries of each science and art extend, they are found to touch at various points on other and kindred ones; the limits which divide them become fainter and fainter, until it is found impossible to determine where the one ends and the other begins. At the present period no science or study can stand alone; its resources have to be drawn from a wider and ever extending field; so that whilst the vast expanse of knowledge requires more and more a division of labour for its cultivation, the necessity of co-operation and mutual aid becomes continually more apparent. If we take the oldest and probably the sublimest of the sciences, that of Astronomy, we find involved with it, from the earliest period, mathematics and geometry; optics, and the construction of optical instruments, next came in aid, and of late, chemistry has most unexpectedly and opportunely contributed most powerfully towards the elucidation of the structure of the heavenly bodies, and to what may be called the "solidarity" of the solar system. I know of nothing more beautiful in the history of scientific progress than the application of the spectrum analysis to the discovery of the materials existing in the solar and stellar atmospheres. If from astronomy we turn to geology, we find this science assuming dimensions so large as almost to appropriate to itself the services of several other independent departments of inquiry. Botany, anatomy, vegetable and animal physiology, conchology, meteorology, chemistry, the nature and extent of dynamic forces—all pour in their several streams to swell the tide of progress, and latterly the boundary which formerly appeared intangible and unapproachable, connecting geological changes with the history of the human race, is beginning to be dimly defined and laid down.

Without going through the entire circle of the sciences, we find this communion and interpenetration everywhere taking place. Sometimes the coincidence and illustrations thus arising are of the most unexpected and striking character. Who could have supposed, for instance, that there was anything in common between the study of geology and the newly-established science of language, or that anything could be contributed by the one in elucidation of the other? and yet such is demonstrably the fact. Geology shows, in examining the most recent deposits on the earth's surface, that the forests which once covered a great part of Europe have been successive in their development; that is, that the fir, and the oak, and the beech have prevailed at different periods, the date and continuance of which were unknown and without a clue. Professor Max Müller has recently shown by a comparison of the terms employed in each language traced to its earliest sources, the state of the respective countries in this respect at the time of their first occupation, and the order of precedence and succession, thus connecting in the most interesting manner the latest geological epochs with the earliest condition of prehistoric man. The connection of the physical sciences has been so amply illustrated by Mrs. Somerville, Sir John Herschel, and others, that it is unnecessary to dwell upon it; but every year it is receiving fresh developments. The recent calculations of Sir William Armstrong as to the probable duration of our coal-fields, to which England owes so much of her greatness and power, have naturally excited considerable alarm as to the future of our country; but just at this juncture the grand and noble theory of the identity of heat and motion, and the convertibility of the phenomena of the one into those of the other, points most opportunely in the direction from whence probably a solution of the difficulty may arise. Indeed, no discovery in any department of inquiry ever takes place without communicating an impulse, and giving either a practical application, or a stand-point for further progress in some other.

Nor is this mutual connection and support confined exclusively to scientific pursuits. We find it in literature of every class. History is no longer studied as a detail of battles and sieges, and a mere narrative of events. It brings to its aid illustrations drawn from climate, race, temperature, physical geography, mineral productions, and all the natural or adventitious circumstances which influence human habits and conduct. In this respect the late Mr. Buckle may be said to have founded a new school, which will no doubt stimulate others to follow in the same track, with less prejudice and greater impartiality. Even poetry and the ornamental arts have felt the influence of this expansive spirit. Any one who will carefully study the works of our Poet-Laureate, and the school of which he is the founder, will find a far greater breadth of illustration, and a far wider extent of resources, than are to be found in our older poets. I am, of course, not entering into their respective merits, but merely stating a fact. In Painting, the same influence is shown by a greater absence of conventionalism, and a far more extensive choice of subjects for treatment than formerly prevailed.

I have thus rapidly endeavoured to show that whilst every mental pursuit may be followed with ardour, for its own sake, there is at the same time a ground common to all, arising from the fact that the mind is one and undivided, however various its faculties may be. Like the rays of the sun when separated in the prismatic spectrum, each has its office to perform of usefulness and beauty, in the rich colouring of nature, in the quickening power of warmth and chemical influence, but it is only when united in the glorious rays of the fountain of light that they appear in all their splendour and brilliance.

A platform of this kind is, as it appears to me, provided by the Literary and Philosophical Society, and in this way I think its influence may be most beneficially exercised. The geologist and the classical scholar, the student of history and the mathematician, the natural philosopher and the poet, can here meet on common ground, and by mutual intercourse add to each other's stores of information, and contribute to the common cause of mental progress. It is desirable to see how our favourite speculations and studies appear in the eyes of others who look at them from a different point of view, and free from the particular relations in which we have been in the habit of contemplating them. There is also a great advantage in having a centre of union for men of thought in every department, where mind can sharpen mind, and the faculties be kept in active exercise. There is great need for a union of this kind in a town like Liverpool, so exclusively devoted to commerce.

The question has often been discussed as to the nature and extent of the influence exercised by business pursuits on intellectual life and progress. On the one hand it is asserted that the activity and energy engendered by commercial pursuits will give a capacity and power capable, when turned in a mental direction, of producing great results; that almost all progress in the arts of life has been developed in the great centres of population; that the quickening and stimulating influences of mind acting upon mind, which is found in its greatest extent in our crowded cities, must be favorable to mental progress. It may also be said that every community, whether ancient or modern, in which art, literature, or philosophy, have flourished, has been more or less commercial or manufacturing in its character. Athens, Rome, Alexandria of old, Florence and Venice in the mediæval period, and London and Paris in more modern times, may be mentioned as not more distinguished by their fame in literature and art than for their commercial and industrial successes. It is to Lorenzo the Magnificent, a Florentine merchant, that the restoration of learning and the arts is more indebted than to any other single individual. Gibbon says of him that "his credit was ennobled into fame, that his riches were dedicated to the service of mankind, and that he often imported in the same vessel a cargo of Indian spices and Greek books." All this is, no doubt, true; but there are causes operating in more modern times, and particularly amongst ourselves, which present the subject in a more unfavourable light. Commerce is now conducted on a larger scale, and requires far more undivided attention than formerly. There is a tendency to centralisation and combination in every department. Every community is distinguished by some special pursuit which gives its character to the locality; and the elements, which are discordant from the general object, are gradually eliminated, and drawn elsewhere. Liverpool is essentially commercial—all her interests are bound up with foreign trade. The large operations which are here successfully carried on require a power of mind, and strength of character which are capable of great things, but which are almost entirely absorbed by the daily calls of the exchange and the counting-house. When we add to this the transaction of public business, to which many must necessarily devote themselves, and the claims of the various religious and charitable associations on the time as well as money, of our townsmen, which claims (it may be said to their honour) are nowhere more cordially responded to,—the residue, which is left for the cultivation of science, literature, and the arts, is necessarily exceedingly small.

From this busy uncongenial atmosphere, so unfavourable to the quiet of the student, and so destitute of external aids, it is no wonder that the studious and learned man should make his escape to the vast resources of London, or to the quiet shades of our University towns. Sculptors, and painters, and men of genius have arisen amongst ourselves as well as in other places. The names of Gibson and Ansdell stand high in the rolls of artistic fame, and would do honour to any community; but, as a matter of necessity, the duties of their profession lead them elsewhere. Beyond even these causes, another is at work amongst ourselves, and constantly increasing; I mean the tendency of using the town merely for business, and living at a distance in the pure air of the country, —one of the greatest advantages which modern civilisation affords, but which, nevertheless, has its drawbacks and penalties. Under these circumstances, I am afraid we must admit that the condition of things amongst ourselves is not so favourable as could be desired for the cultivation of literature and science. I say the *cultivation*, as distinguished from their diffusion. We live in a reading age, and, to a certain point, the minds of all our educated townsmen appreciate and enjoy the literature of the day; but this merely receptive process is very different from that active pursuit of knowledge and thirst for the discovery of truth which constitutes what is properly termed study.

But, although I have thought it desirable candidly to acknowledge the peculiar difficulties which exist amongst us in working out thoroughly the objects of a society like this, I am by no means inclined to take a gloomy view of our condition and prospects. Whatever difficulties may exist in carrying out a noble object, there will always be found spirits endowed with temper and edge sufficient to cut their way through every obstacle. Comparatively, they may be few; but in a large community like this their number in the aggregate will always be considerable. The very fact of the uncongeniality of atmosphere in which they move should only tend to unite them more closely in their common pursuit. Nor are there wanting many bright examples of success to encourage those who would brighten their daily path of commercial or professional toil by the pursuit of truth in its higher branches. Bailey, the astronomer, was a stockbroker in the city of London; and our own list of members affords at least one name eminent in the same science, who, until recently, was engaged in commercial life in Liverpool. William Yarrell—whose works on Natural History place him in a very high rank as a student of nature, was all his life a newspaper agent in London. It would be invidious to mention the names of those living amongst us, or a goodly list might be made out even in Liverpool, of men who, in spite of the deadening influences of daily routine, have raised themselves to a high position in the literary and scientific world.

In order to obtain the largest amount of benefit from an association of this nature, there are, I think, one or two leading principles to be kept in mind, which you will, I am sure, pardon me for mentioning, not as any novelty, but merely as bringing into more prominent and immediate notice, what we all are ready to admit. The first is *earnestness*. I mean by this, taking hold of some study or pursuit, and following it out resolutely and determinedly to its results. If this were kept in mind, the papers presented at our meeting, communicating these results, could not fail to be of the highest interest. It must be kept in mind that this society is not one for the diffusion of knowledge, but for the discovery of truth, an institution for mutual study, not for popular instruction. In this point of view I cannot but think that the plan which has been adopted of late, of throwing open our meetings, will have to be carefully watched. In itself the idea is an excellent one, and will be attended with good results in opening wider the portals of knowledge to those members of our families who are necessarily debarred from the means at our own disposal; but, if carried too far, it cannot fail to have a relaxing tendency in substituting the polish of dilettantism for that muscle and nerve and energy which the study of the higher walks of truth will ever require. We ought to be pioneers in the van of science, not the mere distributors and parcellers out of the ground already won. This energy of purpose also ought to lead every one whose name is enrolled to see in what manner he can best contribute some scrap of material at least to the fabric of knowledge which we are all attempting to rear. Individually our attempts may be feeble; but when united, each contributing according to his vocation, the result will be powerful and effective.

The second principle which we should ever bear in mind in the pursuit of our objects is *reverence*. The praises of knowledge scarcely need be sounded at the present day—

> "Who loves not knowledge? Who shall rail
> Against her beauty? Let her mix
> With men and prosper. Who shall fix
> Her pillars. Let her work prevail.
> Let knowledge grow from more to more,
> But more of reverence in us dwell,
> That mind and soul, according well,
> May make one music as before—
> But vaster."

All truth is holy as it is an emanation from the God of truth. The more we know the more we feel our own ignorance. This is generally admitted; but there is something beyond this, that the more we know the more we feel the unsatisfying nature of merely intellectual as compared with moral truth. Pursued in this frame, all studies assume a higher and more dignified character. The faculties preserve their due subordination; and with this guiding clue, we may safely scale the highest peaks of knowledge, assured that our search shall not be in vain.

One other principle I would further briefly allude to—that of *mutual charity and forbearance*. There is a natural tendency in every mind, whatever our pursuits may be, to adopt a certain set of opinions—to run, so to speak, in a certain groove of thought—and any proposition which opens up a new view, inconsistent with the conclusions already adopted, jars upon our frame, disturbs our self complacency, and leads us to view the intruder as an enemy to our peace. This is not peculiar to any study, science, or art. Luther, in the 16th century, was hardly denounced in stronger terms for his heresy in doctrine than Harvey in the 17th, and Jenner in the 19th, for their heresies in physiology and medicine; and even at the present day the propounder of a new theory, the interpreter of the laws of nature in a new sense, has need either to disguise his theory under the garb of an esoteric form, or be prepared to run the gauntlet of criticism frequently most unfair and uncandid. It is a notorious fact that there are no differences more bitter, no judgments more uncharitable than are to be found in the scientific and literary world. That this should be so is simply an infirmity of human nature, which should in every way be discountenanced and discouraged. When a new truth, or what professes to be so, is put before the world, the first enquiry usually is, not is it true—can it be proved? but, how does it square with our existing systems? Does it disturb that settled order, that labelled and ticketed arrangement of ideas with which we are familiar? If it does, then the course we often pursue is either to reject it as a heretical intruder and heap upon it ridicule and contempt, or to look upon it with coldness and suspicion until by slow and painful degrees it has won its way to notice and takes rank as a familiar axiom. Under such circumstances we ought to remember that all truth is essentially harmonious. No single truth, whatever be its nature, can by possibility contradict any other truth. However new, or harsh, or strange it may appear, it will ultimately be found to coincide and harmonise with every recognised principle which has its base on the same firm foundation. Let us hear the noble words of John Milton on this subject. He says in his "Plea for the Liberty of Unlicensed Printing," "Where there is much desire to learn, there of necessity will be much arguing, much writing, many opinions; for opinion in good men is but knowledge in the making. Under these fantastic terrors of sect and schism we wrong the earnest and zealous thirst after knowledge and understanding which God hath stirred up among us. * * * A little generous prudence, a little forbearance of one another, and some grains of charity, might win all these diligences to join, and unite into one general and brotherly search after truth; * * * I doubt not, if some great and worthy stranger should come among us, wise to discern the mould and temper of a people and how to govern it, observing the high hopes and aims, the diligent alacrity of our extended thoughts and reasonings in the pursuit of truth and freedom, but that he would cry out as Pyrrhus did, admiring the Roman docility and courage: 'If such were my Epirus, I would not despair the greatest design that could be attempted to make a church or kingdom happy.' Yet these are the men cried out against as schismatics and sectaries, as if, while the temple of the Lord was building, some cutting, some squaring the marble, others hewing the cedars, there should be a sort of irrational men who could not consider that there must be many schisms and many dissections made in the quarry and in the timber ere the house of God can be built. And when every stone is laid artfully together, it cannot be united into a continuity, it can but be contiguous in this world; neither can every piece of the building be of one form; nay, rather the perfection consists in this, that out of many moderate varieties and brotherly dissimilitudes that are not vastly disproportioned, arises the goodly and the graceful symmetry that commends the whole pile and structure."

These are pregnant and powerful words, worthy of the great man who penned them. We are labouring, as he describes, in our humble way, "some cutting, some squaring the marble, others hewing the cedars," but all, we trust, endeavouring to further the building of the great temple of truth. Nay, we may even be ignorant of the particular place which our work shall occupy, but if we be true men, labouring for the truth's sake, we may be certain that our work shall find its place in that great temple of which we only see the foundations, but of which the crowning summit shall be developed in a glorious hereafter.

On the whole, then, notwithstanding the drawbacks to which I have slightly made allusion, I do not think there ever was a period when our position as a society was more prosperous or our prospects brighter. Amongst other causes for this may be mentioned the constant influx into the town of men of intelligence and education, who find Liverpool a fit arena for their energy and enterprise, and who bring amongst us new blood, so to speak, of a vigorous and healthy character. Intelligent strangers have always found amongst us a warm and cordial welcome, and have contributed very largely to render the town and its institutions what we now see them. Within these walls, dedicated for so long a period to the cause of science and literature, they will ever be honoured guests, until they become merged into active participators of our studies and pursuits. If we desire tangible proofs of the results of the society's career, we may point with satisfaction to the published proceedings, which contain a varied and most interesting series of papers on a large number of subjects, both of literature, science, and art. These will necessarily increase in interest as years roll by, and will form a very valuable history of the progress of thought in this locality on a vast variety of subjects. It is not too much to say that the published transactions of the Liverpool societies, including the Historical, the Architectural, and the Literary and Philosophical possess an interest and value surpassed by those of no other provincial society in the kingdom. Many of them have been extracted and published elsewhere, and several translated into foreign languages. I trust that this will be borne in mind by our members, and that in all the papers presented, the prospect of publication will always be kept in view.

Another feature of our meetings which has always possessed high interest, is the literary and philosphical intelligence which usually occupies the earlier portion of our proceedings. The free interchange of thought proceeding from this source, the information communicated and the discussions arising, have always appeared to me to possess great value. Hints are dropped, which, falling like seeds into fertile soil, are developed into thoughts and ideas, which expand and bear fruit in future days. May we hope that this portion of our usual proceedings will during the ensuing session receive its due share of attention.

When we contemplate the present state of the civilised world, in its relation to science, there appears to be great cause for congratulation. Man appears to stand on an eminence which rises higher and higher with each successive victory over the powers of nature. He seems to have realised the description given by the Psalmist—"Thou hast made him a little lower than the angels, and crowned him with glory and honour. Thou madest him to have dominion over the works of thy hands; thou hast put all things under his feet." What is there which is not subservient to his behests? The winds and the waters are his captive slaves to grind his corn, to saw his wood, to turn his machinery, to speed his way; the sun paints his pictures; the bowels of the earth yield their long accumulated treasures of power in our coal and iron; the very lightning is imprisoned and sped upon messages, like Puck—

> "To put a girdle round the earth
> In forty minutes."

The subtle laws of chemistry are invoked to analyse, combine, separate, and adapt the substances of which this earthly frame is composed, to his wants and pleasures. The everlasting hills, when interrogated, reveal the strange history of their formation and elevation. The earth beneath our feet turns over leaf after leaf in its record of ages too vast for calculation, and passes in review before our eyes pictures such as fancy could never have dreamed, of "gorgons and chimæras dire" which once had a real and living existence, and were masters of the earth as we are now. Nay, the very sun and centre of our system is put to the question, and forced to reveal, to some extent at least, his nature and constitution, and worlds unnumbered are brought to light where all was previously thought to be empty space; whilst at the other extremity a world of life and beauty has sprung into notice and regard, too minute to be perceived by his unaided organs. The vegetable and animal world, within certain limits, is modified and adapted to his wants and pleasures. Indeed, it seems impossible to set a limit to man's progress in physical science and his power over the material world. So far we stand on vantage ground never enjoyed by the world before.

In these pursuits the division of labour is of necessity carried to its utmost limits, and each pursues his own department almost exclusively. In the world of letters the case is somewhat different. The accumulation of literature on every subject capable of being illustrated is becoming something almost overwhelming to contemplate. Much of it from age to age is consigned to deserved oblivion, but much survives to such an extent at least as requires some knowledge of it by every man of education and cultivation. The great extent of this rendering its absolute mastery impossible by any single individual, has led to the establishment of another class of literature in the reviews and magazines from which abstracts and breviates are obtained of what it is impossible to read at length. Notwithstanding these aids, the amount of reading absolutely requisite to keep *au courant* with the age is probably greater than at any former period. Archbishop Thomson has recently touched on this subject in an address delivered at Leeds. There is no doubt that it is possible by too much diffusive reading, even of a healthy class, to weaken the fibre of the mind and unfit it for manly, vigorous thought. A society such as ours has a beneficial tendency towards correcting this evil, in leading us to read for a purpose, to adopt method and order in our literary recreations, to select some subject for study and illustration, and endeavour to master at least its general principles, and thus contribute some little aid towards the general advancement. The difference between desultory reading and study is enormous. The one is like the inspection of a shifting panorama, which leaves on the mind a pleasing, but indefinite and shadowy sense. The other is like digging in a mine, where every stroke yields a return in treasure, amassed for future use.

I have alluded to the steady advance of [physical science, and man's mastery over the elements. In mental science, meaning by that the study of our own minds and faculties, the same cannot be said. Here little, if any, progress can be shown to have been made. Political economy, which holds a middle place between physical and mental science, treating, as it does, of man's motives and habits, as developed by the pressure of his wants and interests, has become better understood; but, as a science, it is still far from perfect, and from its principles being established on an incontrovertible basis. Social science, which treats of man in his character of a domestic and social being, and of all that relates to his welfare as a member of society, has made considerable progress of late years, and has been the originating cause of many needful reforms. Pure mental science, however, still remains much as it has always been from the dawn of Greek philosophy. The reason is obvious. In all physical sciences the achievements of one age become the starting point of the next, and thus progress may be carried forward with an accelerated ratio; but in mental science, every age, every student must start from the depths of his own consciousness, and the writings and experience of former ages can only be of use as leading lines, which our own thoughts may traverse to form their own conclusions.

I must now bring to a close these desultory observations. My object has been, however imperfectly carried out, to indicate the position which this society may usefully occupy in the present condition of the scientific and literary world, and under the peculiar conditions which exist amongst ourselves. We have, I believe, a high and noble task to perform, in providing a means for soothing the asperities of daily life ; in enabling us to forget for a time the anxieties of business, and the irritations of the counting house; in the cultivation of those faculties which God has given to us for nobler ends than the pursuit of business, however successfully, and the amassing of wealth, however enormous ; in the diffusion within our respective circles of a taste for whatever is beautiful in nature and art; in calling attention to the wonders developed in the works of God around us ; and, finally, in contributing to the elevation of the tone of the mental and moral atmosphere about us. If we keep these objects steadily in view, the Literary and Philosophical Society cannot be said to have existed in vain.

This address was listened to with great interest, and at its conclusion a vote of thanks was carried by acclamation, on the motion of the Rev. H. H. Higgins, seconded by the Rev. J. Robberds.

FOURTH ORDINARY MEETING.

ROYAL INSTITUTION, November 30th, 1863.

JAMES A. PICTON, F.S.A., PRESIDENT, in the Chair.

Dr. COLLINGWOOD detailed some curious observations made by Col. Stuart Wortley upon the habits of Prideaux's hermit-crab and the Cloak Anemone (Adamsia.) These two animals, it is well known, are always associated together, but are difficult to keep in the aquarium. Col. Wortley had, however, succeeded, and had observed the attachment they appeared to have for one another, and had seen the crab feed the anemone when his own hunger was appeased, and remove it to a new shell when he himself removed.

The Rev. Dr. GINSBURG having taken the chair, the following paper was read :—

ON SANSKRIT ROOTS AND ENGLISH DERIVATIONS.

By J. A. PICTON, Esq., F.S.A., President.

In two papers previously read before this society, I have endeavoured to illustrate the identity of our own mother tongue, in all its essential elements, with the ancient Gothic, the earliest form of Teutonic speech handed down to us. I have also shown that the position which the Gothic language holds, presents great facilities for tracing the connexion of the Teutonic branch with the other great stems of the Aryan family of tongues, especially with the Greek, Latin, and Sanskrit. It is my purpose in the present paper to continue the inquiry, by calling attention to a few instances of the radical connexion still to be traced, between the members of the family most widely separated both by time and space; the one from the extreme East, and preserving in its grammatical character the earliest forms,—the Sanskrit; and the other, occupying the most advanced post to the West, and in many respects of the most modern development—our own English tongue. A few years ago any attempt of this kind would have been simply impossible, but the patient labours of the modern school of philology have done much towards removing the difficulties, by investigating the laws of language in its permutations, and by establishing principles which may be relied on in inquries of this nature. Amongst these inquirers stands pre-eminent the name of Franz Bopp, the publication of whose *Vergleichende Grammatik,* the first part of which appeared in 1833, created an entirely new era in the science of Philology. Up to that time, etymology had been little more than a series of guesses, frequently shrewd and acute, but based on no principle, and appealing to no general laws. Jacob Grimm, the commencement of whose *Deutsche Grammatik* was published in 1822, has exhausted the subject of the Teutonic languages in their co-relation and comparison, but to Bopp we owe the establishment of the laws of language on such sure and settled foundations, that future inquirers may tread firmly, and advance with confidence, where formerly every step was treacherous and uncertain. The labours of Bopp have been ably followed up by Professor F. Pott, of Halle, in his *Etymologische Forschungen*, (Lemgo, 1859,) and latterly in our own country by Max Müller, whose "Lectures on the Science of Language" have done much to draw the attention of the educated classes to the importance and value of philological studies, and the interest attaching to them. Hitherto, however, not much has been done towards tracing out the connexion of our own language with the earliest of its congeners. Bopp's *Comparative Grammar* has chiefly to do with principles, laid down in the most masterly way, but adapted only for scholars. Our own etymologists almost uniformly terminate their inquiries with the Anglo-Saxon, Latin and Greek. One of our latest writers, Mr. Hensleigh Wedgwood, whose *Dictionary of English Etymology* now in course of publication is most valuable, never attempts to go beyond the Gothic in his illustrations. The only English philologist, so far as my observation goes, who has drawn upon the Sanskrit for illustrations, is Mr. Oswald Cockayne, in his recent lively and interesting work entitled *Spoon and Sparrow*, and this only in a tentative and unsystematic manner. In Germany, in addition to the work of Professor Pott already alluded to, an elaborate volume was published at Vienna, in 1852, by Professor Holmboe, of Copenhagen, shewing the connexion of the Norse languages with the other Indo-European tongues,—illustrated by a large number of

Sanskrit examples.* With these exceptions the field is unoccupied, and will yield a fruitful harvest to the diligent investigator.

If we compare words in different languages, of the identity of which there can be no question, we find considerable differences in the forms which they assume, for instance—

English,	thief	German,	dieb
English,	door	German,	thür
English,	creep	Latin,	serp-o

Further examination has shewn that these transmutations are not arbitrary and capricious, but in all their varied forms exhibit the presence of *law*, often plain and simple, frequently subtle and delicate, and sometimes difficult and obscure. This is the great principle of modern philology, which has already produced great results, and promises still greater. By the discovery and application of these general laws, relations and affinities have been detected between languages formerly considered entire strangers to each other; converging lines have been traced, so to speak, pointing in the direction of the common centre of widely extended families of speech, and the chaotic Babel of human tongues has been reduced to something like order and system.

One of the most valuable discoveries was the fact that particular letters or sounds in certain languages are uniformly represented in certain other languages by other special letters or sounds. This is called Grimm's law of Phonetic Transmutation. For example we find the Sanskrit दशन् daśan represented by—

Greek,	*δέκα*
Latin,	*decem*
Gothic,	*taihun*
English,	*ten*
High German,	*zehn*—formerly *zëhan*

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* "Det norske sprogs, vœsentligste ordforraad, med Sanskrit og andre sprog af Samme Æt." Wien, 1852.

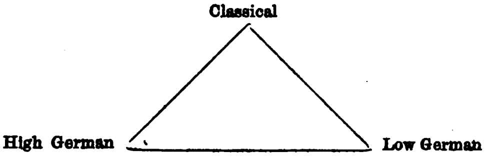
It will be seen that the three first have *d* for their initial letter, the two second *t*, the last *z*. From various instances of this kind the Indo-European languages have been separated into classes; the Sanskrit, Greek, and Latin, forming one group which may be called the classical; the Gothic, the Norse tongues, and the Low German dialects, including the Anglo Saxon, forming a second; and the High German—now consisting of a single language, but formerly divided into various dialects, the Theotisc, the Alemannic, the Francic, &c.—forming a third.* This law of transmutation applies to consonants only, the vowel changes being accounted for differently. The consonants thus affected are classified as Tenues, Medials and Aspirates, thus—

	Labials.	Dentals.	Gutturals.
Tenues	P	T	K
Medials	B	D	G
Aspirates	F	TH	CH
		Z	H

The relation of these letters to each other in the cognate languages, as classified above, stands as follows:—

Greek, Latin, Sanskrit.		Gothic and Low German.		Old High German.
Tenuis	answers to	Aspirate	answers to	Medial
Medial	„	Tenuis	„	Aspirate
Aspirate	„	Medial	„	Tenuis

The curious fact is here shewn that the Old High German stands to the Gothic in the same relation as the Gothic to the Classical; where the Gothic substitutes an aspirate for the Greek tenuis, the High German substitutes an aspirate for the Gothic tenuis, and so with the other letters. This relation may be represented geometrically, in a triangular form, thus—



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* The Celtic, Lithuanian, and Slavonic languages, equally belonging to the general Aryan stock, form no part of the present inquiry.

Starting from an angle and going round with the sun, the kindred letters always follow in the same order as indicated above. Or it may be illustrated thus—Any of the letters at any of the angles has always the same relative letter on the left and right. Thus, a tenuis has alawys a medial on the right, and an aspirate on the left. A medial has an aspirate on the right and a tenuis on the left. An aspirate has a tenuis on the right, and a medial on the left. These inter-relations are curious and interesting, but their origin and the regularity with which they occur are at present quite beyond the reach of our inquiries.

The table of permutations is as follows—

	Greek, Latin, Sanskrit.	Gothic and Low German.	Old High German.
Tenues	P	F	B or V
	T	TH	D
	K	H	G
Medials	B	P	F
	D	T	Z or TH
	G	K	CH
Aspirates	F	B	P
	TH	D	T
	CH H	G	K

I have only space to give one or two illustrations of the operation of this law—

I.—INITIAL CHANGES.

Sans.	Lat.	Gr.	Gothic.	Old High Ger.	English.
twam	tu	τυ	thu	du	thou
bhri	fero	φέρω	baira	piru	bear

MIDDLE CHANGES.

upari	super		ufar	ubar	upon

INITIAL AND MIDDLE.

kapâla	caput	κεφαλή	haubith	haupit	head

Grimm's law, though exceedingly valuable, is liable to many limitations and exceptions, principally arising from the fact that most, if not all, of these cognate dialects had undergone further changes and corruptions previous to the date of the earliest specimens handed down to us. The most archaic forms of each language approach the nearest to the ascertained law.

In order to render intelligible the remarks which follow, I must now say a few words on the Sanskrit alphabet, probably the most scientific and elaborate phonetic arrangement which is found in any language. In a rapid sketch like the present, I must pass by the vowels and diphthongs, merely remarking that they consist of long and short *a*, long and short *i*, long and short *u* ; *o* and *e*, the diphthongs *ai* and *au* ; *ṛi* is treated as a vowel long and short, and the combination *ḷri* is also classed as a vowel, though only found in a single word.

The consonants are classified according to the organs employed in producing them, commencing at the throat and ending at the lips.

GUTTURALS.

Hard, surd or tenuis	क	k
Soft, sonant or medial	ग	g
Hard, aspirated	ख	kh
Soft, aspirated	घ	gh
Nasal	ङ	nk ng
Simple aspirate	ह	h

PALATALS.

Hard	च	ch
Soft	ज	j
Hard, aspirated	छ	chh
Soft, aspirated	झ	jh
Nasal	ञ	nch nj
Sibilant	श	sh

CEREBRALS.

Hard	ट	t
Soft	ड	d

Hard, aspirated	ठ	th
Soft, aspirated	ढ	dh
Nasal	ण	nt nd
Sibilant	ष	zh

DENTALS.

Hard	त	*t*
Soft	द	d
Hard, aspirated	थ	th
Soft, aspirated	ध	dh
Nasal	न	nt nd
Sibilant	स	s

LABIALS.

Hard	प	p
Soft	ब	b
Hard, aspirated	फ	ph
Soft, aspirated	भ	bh
Nasal	म	m

SEMI-VOWELS.

य y   र r   ल l   व v

It will be seen that whilst the Sanskrit possesses many sounds which are lost in the cognate languages, others are deficient, such as the sound of *f*, and the dental aspirate represented by the English *th*. The palatals are not found in either Latin, Greek, Gothic or High German—that is in their early forms. They have been subsequently introduced into most of the modern European languages.

I now come to the consideration of the Sanskrit roots, the ultimate results of the closest analysis directed to the subject, and beyond which inquiry cannot go. They are, so to speak, the elementary atoms out of which the wonderful structure of the Aryan family of tongues has been built up. It would be too much to assert that all the radical forms of every

Aryan language are to be found in Sanskrit. A large number have doubtless been lost in Sanskrit, which form essential elements of other tongues, as many exist in Sanskrit which other tongues have not retained, but thus much may be asserted, that many Sanskrit roots are extensively diffused throughout every Aryan language, and that Sanskrit is the only language in which true roots have been preserved. This arises from the peculiarities of Sanskrit grammar, a large portion of which consists in the formation from the roots of crude forms or bases capable of inflexion.

A Sanskrit root is a primary monosyllabic sound "which conveys some simple idea appearing under different modifications in the derivatives from it." * Contrary to the theories of our older writers on language, these roots all convey abstract ideas, though of the simplest kind; for instance जीव् *jív* conveys the idea of life or living, but it is neither a substantive, verb, nor any other part of speech, and cannot be employed as such until it has undergone certain modifications. To live is जीवितुं *jívitum*; life is जीवं *jívan*. The prolific nature of these simple roots we shall see presently.

There are about two thousand roots in the Sanskrit language as it exists, but many of these are only secondary and derivative, though grammatically treated as roots. Bopp is of opinion that on close investigation they might probably be reduced to about five hundred.

The Sanskrit roots are of two classes; Verbal, from which spring verbs and nouns, and Pronominal, from which spring the pronouns, and all original prepositions, conjunctions and particles. The former class is by far the most numerous and prolific. From this class my illustrations will be chiefly derived.

The Verbal roots are divided into ten classes according to the mode in which the declinable base is prepared for inflexion. Two modes of conjugation are adopted, the Parasmai-pada, (words for another) used for active transitive verbs, and the Atmane-pada, (words for one-self or soul words) used principally in the sense of the middle and passive voices.

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* Monier Williams' Sanskrit Grammar, 2nd edit., p. 39.

I have made these explanations as short and simple as possible; but some preliminary remarks were absolutely necessary to enable those who may not have turned their attention to the subject to understand what follows. I will now proceed with my illustrations.

One of the simplest abstract ideas is that of stability, expressed by the English word to *stand*. Radically this word is found in every Aryan language in an almost infinite variety of forms, the connexion between which previous to the study of Sanskrit, it was almost impossible to determine. They are all now traceable to the root स्था sthá (1st class Parasmai and Átmane) inflected in the present tense *tishtami*, *tishtasi*, *tishtati*; Zend or old Persian *histami*. In Greek we have *στάω*, which has been abandoned for its derivative *ἵστημι* to stand; *στοά*, a place, a colonnade; *στῆλή* a column, *στά-διος* standing firm, &c. In Latin—*sto*, *sta-re*, *sta-tio*, *sta-tuo*, (to cause to stand, to appoint), *sta-tor* (one who appoints), *sta-tua* (a fixed image), *sta-tura*, *sta-tim*, *sta-tus*, *sta-bilis*, *sta-gnum*, *sta-bulum*, *&c*. In compounds—*si-sto*, *ob-sto*, *con-sto*, *re-sto*, *ex-sto*, *super-sto*, *inter-sto*, *con-sti-tuo*, *re-sti-tuo*, *sub-sti-tuo*.* Slavonic, *sto-ju* to stand; Hibernian, *sta-d* to stop; Gothic, *sta-nden*, with its compounds, *af-standan*, *at-standan*, *bi-standan*, *mith-standan*, *in-standan*, *us-standan*, *&c.*, *sta-ths*, a place, *stains* a rock, a stone.

In Old German we have the crude form near akin to the root in *stan*, (Mod. Ger. *ste-hen*), from which proceed a very large number of derivatives, *gi-stan* (bestehen), *ana-stan* (anstehen), *ar-stan* (erstehen), *fora-stan* (verstehen), &c.,

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* For the change of *a* into *i* in these compounds, see Bopp, Comp. Gr., § 6, and cxi.

with a large number of compounds; *stiftan*, to appoint, place, with its compounds. *Sto-c,* the trunk of a tree, a beam; *statt—stadt,* a place, a city. In Anglo-Saxon, *sta-ndan, sta-pol,* an appointed place, a prop; *sta-thol,* a foundation; *stæf, stóc, stow,* (a place); *sta-ith, ste-de, &c.*

The Low German dialects, the Old Saxon, the Old Frisian, the Dutch, and the Norse languages have all corresponding classes of words from the same root.

In English their name is legion, descended to us both from the Teutonic and Classic sources of our language—*sta-nd, sta-te, estate, sta-ndard, sta-tion, sta-tionary, ste-ad, ste-ady, sta-ple, sta-ble, sta-tue, sta-tute, sta-ture, sta-ted, sta-y, sta-gnant, sta-unch, sta-ll, sta-ke, sta-ge, sta-ck, sta-ff, sta-ith, sto-ne, &c.* When we consider that these (and many more) are merely modifications of the primitive idea expressed by the root *sthá,* we may begin to appreciate the prolific nature of language; its vast capability of extension and accommodation to the necessities of human thought, and the simplicity of its laws in its earliest development.

Our word to "*go*" expresses the simple idea of voluntary motion. It finds its root in the Sanskrit—गम् *gam,* Parasmai 1st class. Present *gachchhami,* Infin, *gantum.* The form in Zend is *Z'engiù.* Lithuanian *kan-ku.* Gothic *gan-gan,* with its compounds *at-gangan, mith-gangan,* &c., *gangs*—a street, gate, passage—

Old Saxon,	*gan-gan*
Anglo-Saxon,	
Old German,	
Old Low German,	*gan-ga*
Old Frisian,	*gun-ga*
Swedish,	*gå*
Danish,	*gaa*
Modern German,	*ge-hen*

Bopp is of opinion that to "come" is derived from the same root, to which he refers the Latin *ven-io,* originally *guem-io.*

Gothic,	*quam, quiman*
Old German,	*quem–an*
Old Saxon, Anglo-Saxon,	*cum-an*
Old Low German,	*kom-a*
Old Frisian,	*kum-a*
Holl.	*kom-en*
Swedish,	*kom-ma*
Danish,	*kom-me.*
Modern German,	*kom-men.*

In the Gothic language *quiman* and *gangan* are not unfrequently employed to express the same meaning as equivalents for the Greek ἔρχεσϑαι; so Mat. 3, v. 11—"He that *cometh* after me is mightier than I." Gothic—"Sa afar mis *gangida* svinthoza mis ist." Mar. 1, v. 7—"There *cometh* one mightier than I after me." Gothic—"*Qimith* svinthoza mis sa afar mis." This tends to confirm Bopp's theory of their common origin.

There is a word much used by our old writers, *steyen,* or *steighen,* expressive of motion upwards, which has unaccountably disappeared from our language since the time of Chaucer and Wickliffe. Its root is found in the Sanskrit स्तिघ् *stigh ;* 5th class, Parasmai, *stighnomi, stighnosi, stighnoti.* Greek, στείχω, to go up.

The only trace of the root in Latin is *stega,* Greek, στέγη, the deck or raised part of a ship.

Gothic, *steig-an,* to ascend, *steig-a,* a path

Old Low German, Old Frisian, Swedish,	*stig-a*
Danish,	*stig-e*
Holl.	*stij-gen*
Modern German,	*steig-en, steg,* a wooden bridge.

Anglo-Saxon, *stigan*, *stigh-el* (a stile), *stig-rap* (stirrup), *stag-ers* (stairs), *stig-e* (a ladder, still called provincially a "*stee*," or "*steigh*.")

"Sothely aftir thes dayes we made reedy and *steygeden* to irlm."—Wickliffe. Acts of the Apos., ch. 21, v. 15.

> "He *steigh* up to hevene
> And on his fader ryght hand
> Redelich he sitteth."
>
> Piers Ploughman. Crede.

We have in the English language two classes of words descriptive of the relations arising from birth and race. One class is derived from Latin and Greek, such as *gentle*, *genealogy*, *genius*, *generate*, &c.; the other of native Teutonic origin, such as *kin*, *kind*, *kinsman*, &c. Both these classes find their origin in the Sanskrit root—

जन् *jan*. Conjugated in the Parasmai form, 4th class, it signifies to produce, originate, beget.

Present. *jajanmi*, *jajansi*, *jajanti*.

Infinitive. *jajanitum*.

In the Átmane form, 3rd con., it means to be born.

Present. *jáye*, or *janye*, *jáyishe*, *jáyite*.

Infinitive. *jáytum*.

Greek, γεν-ω, γίγνομαι, to be born, to be.

γεν-εά birth, γέν-ος race, γεν-εσις origin, beginning, &c.

Latin, *gen-o*, altered to *gign-o*, to beget; *gn-ascor*, to be born; *gen-s*, *gen-us*, *gen-itus*, &c. *In-gen-ium*, *in-gen-uus*, *pro-gen-itor*, &c.

The Sanskrit जनक *janaka* is equivalent to Latin *geni-tor*, father. जनको *janako*, woman, corresponds with Greek γυναικ from γυνακι. जन *jana*, man, probably in the feminine जना *janá*, corresponds with

Greek, γύνη
Guthic, *qvino*

Theotisc, *qvino*

English, *quean*
queen

The English words derived from the Classical source are very numerous, and branch out into a great variety of meanings—*gen-ealogy, gen-eral, gen-erate, gen-ital, gen-eric, generous, gen-ius, gen-ial, gen-tle, gen-teel, gen-tile, gen-uine, gen-us,* with their compounds.

The Teutonic stem gives us

Gothic,	*kuni* (race, kin).
Old German,	*kun-ni*
Old Saxon,	*cun-ni*
Old Low German,	*kyn*
Old Frisian,	*ken*
Hollandish,	*kun-ne*
Swedish,	*kön*
Danish,	*kjon*
Anglo-Saxon,	*cyn, cyn-ren*
English,	*kin, kindred, kinsfolk, kind, kinship, kindle,* (to bring forth.)

Our word *king,* Anglo-Saxon, *cyning,* has often been fancifully connected with *cun-ning* and *can-ning, i.e.,* the man that *kens,* or the man that *cans,* on the principle that "knowledge is power." But there can be little doubt that the true etymology is from *cyn,* race, and *ing,* son or descendant, the man of birth, or of noble race, in the same manner that *ætheling,* "the son of the noble one," was used as the title of the king's heir.

The root ज्ञा *jná,* though quite distinct in Sanskrit from the last, has given rise to some confusion in the cognate languages, from the close resemblance of the derivatives. It signifies to "know," and is conjugated in the Parasmai and Átmane forms, 9th class.

Present,	*janami, janasi, janati.*
Greek,	γνο·εω, γὶνώ·σκω

Latin,	*gno-sco, co-gno-sco*
Gothic,	*kunnan*
Old German,	*kunnan*
Swedish,	*känna, kunna*
Danish,	*kjènde, kunne*
Hollandish,	*kennen*
Mod. German	*kennen, könen*
Anglo-Saxon,	*cnawan, kunnan*

There can be no doubt that our auxiliary *can*, like the German *können*, is an adaptation of the primary meaning, knowledge, implying ability. Chaucer uses *can* in the sense of knowing, *conne* in the sense both of knowledge and ability.

> " I wot wel Abraham was an holy man,
> And Jacob eke, for as ever I *can*."
>
> *Wife of Bathe's Tale.*

" Then said Melibee : I shall not *conne* nswere unto so many faire resons as ye putten to me."

Tale of Melibeus.

The double derivation of which I have spoken, is found in many classes of English words with changes of meaning more or less important. The terms *mortal, immortal, &c.*, referring simply to decease, are derived from Sanskrit through Greek and Latin. The word *murder*, implying a violent death, is derived from the same root by a Teutonic descent.

मृ	*mṛi* or *mar*, to die ; Causative to kill, to slay.
	6th Con. Átmane.
Present	*mriye, mriyase, mriyate*
मृत	*mrita*, mortal
Latin,	*mor-i*, to die ; *mor-s*, death ; *morbus*, disease ; *im-mor-talis*, deathless.
Greek,	*μόρος*, death, fate ; *ἀ-μβροτός* for *ἀ-μρο-τός*, immortal.
Lithuanian,	*mir-ti*, to die
Russian,	*s-mer-ti*, death

From this primitive meaning of the root our words *mortal, immortal, &c.*, are derived.

From the Causative sense, to kill, slay, descend—

Gothic,	*maur-thr*, murder
German,	*mord, morden*
Anglo-Saxon,	*morth, mor-thor, &c.*
Swedish,	*mord*
Danish,	
Hibernian,	*mar-bhaim*, I kill ; *mar-bhan*, a corpse.

The recent progress of a sound system of philology and the light derived from the study of Sanskrit are well shewn by reference to the speculations on these words. Horne Tooke* derives *murder, morrow, and mirth*, from the same original, which he says is found in the Gothic and Anglo-Saxon verb *merjan, merran*, which means to scatter, to dissipate. *Mirth* is the third person singular of the verb, and signifies that which dissipateth care and sorrow. *Morrow* and *Morning* are the past tense and past participle, and signify the dissipation of clouds and darkness. The Anglo-Saxon *Morthe* is that which dissipates life, and hence is derived French *Meurtre* and Latin *Mors*.

The speculation is ingenious, but will not bear examination. To say nothing of the odd notion of a Latin radical being derived from an Anglo-Saxon inflexion, it may suffice to remark that the Gothic *merjan* has in no case the meaning of "to scatter, dissipate." Its uniform signification is "to declare, announce, preach," and is the equivalent of Greek *κηρύσσειν, διαλαλεῖν, εὐαγγελίζεσϑαι* ; "*merjands daupein idreigos*," "preaching the baptism of repentance."

Dr. Richardson adopts Horne Tooke's etymology, with a slight difference, suggesting that the Gothic verb *maurthrjan* was probably formed from the third person singular of Anglo-

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* Diversions of Parley. Taylor's Edition, 1857, pp. 461, 614.

Saxon ***myrran*** to mar, and the English noun and verb from this.

We are not here concerned with the etmology of ***Mirth*** and *Morrow;* whatever may be their derivation, the direct connexion of Latin *mors,* Gothic *maurthr,* English *murder,* with the Sanskrit root *mṛi,* is clear and distinct. When such haphazard guesses as these are put forth as serious inferences by our highest authorities, it is manifest that the whole system of our English etymology requires revision.

Many of the Sanskrit roots, in the vital energy which they display in accommodating themselves to the progressive necessities of human thought, have put forth derivatives widely extending the application of the original idea, but in most cases the connexion is capable of being traced, and possesses considerable interest, from the light it throws on the progress of the human race. I will give a few instances of this kind—

दम् *dam,* 4th class Parasmai
Present *damyami, damyasi, damyati*
Infinite *damitum*

The primitive idea in this root, which we shall find more or less involved in all its derivations, is that of arranging, setting in order. In the causative form applied to inanimate objects, it means to put together, to construct *(ligare, struere);* applied to living beings it means to tame, to subdue. In the neuter it has the sense of fitting, becoming. दमन *damana* means a tamer, equivalent to the Greek *δαμ–ος, ἱππόδαμος* a horse-tamer. In this sense we have—

Greek, *δαμ–άω, δαμ–αζω*
Latin, *dom-o*

In Gothic, according to Grimm's law, the medial "d" is changed into the tenuis "t" and it becomes *tam-jan,* Anglo-Saxon *tam-ian,* English *tame.* In High German the tenuis "t" is further exchanged by Grimm's law for the aspirate "z" equivalent to "th," and it beomes *zähm-en*, to tame, whence *zaum*, a bridle.

The Swedish, Danish, and Hollandish, follow the Gothic in the word *tam*.

The primary meaning of the root, that of order and arrangement, is shewn in the word **दम** *dama*, which means soothing the mind after perturbation. This is further carried out by applying it to the family connexion, **दम्पती** *dampati*, signifying a married pair, wife and husband.

The same application is made in Greek, where *δαμ-αρ* means "a wife or spouse," whilst a maiden was called *ἀ·δαμ-άστος*, one untamed or unyoked.

In Latin this sense is widely applied. *Dom-us*, originally means the home, the family, rather than the building in which they dwell. *Dom-inus* and *dom-ina* are the master and mistress of the household, whence a large class of secondary forms, *dom-icilium, dom-inor, dom-esticus, dom-inium,* (a feast in the house), &c. The derivatives from this source are very numerous in the Romance languages, *dam-a, donna, don, dame, ma-dame, ma-dem-oiselle, dim-anche, (from dominica,) &c.*

In English also this branch from the root has been very prolific. We have *dame, dom-e, dom-estic, dom-ain, dom-inate, dom-ineer, dom-icile, dom-inical, &c.*, principally through the French, this application of the root not having obtained currency in the Teutonic languages.

In the sense of being fitting or becoming, we have Gothic *tim-an*.* Luke v, 36—"The piece out of the new *agreeth not* with the old."

Gothic—"thamma fairnjin ni *ga-tim-id* thata af thamma niujin"—

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* For the law of change from the Sanskrit "a" to the Gothic "i," see Bopp, *Comp. Gram.*, I, p. 56.

Old German,	*zim-en*
Modern German,	*ziém-en*
Anglo-Saxon,	*sem-an*
English,	*seem, be-seem*

As applied to inanimate things in the sense of construction we have—

Greek,	*δεμ-ω*,	to build, construct
	δεμ-ας,	the human frame
	δόμ-ος,	a building
	δῶμ-α,	

According to Grimm's law, the *dem* of the Greek becomes *zim* in High German, and *tim* in the Gothic dialects. Our word *timber* is usually supposed to apply exclusively to wood, and is traced by Pictet[*] to Sanskrit, दम्भ् *dambh*, to burn. This derivation, however, is not borne out on full inquiry.

In the Old Teutonic dialects—

Old German,	*zim-bar*
Gothic,	*tim-r*
Norse,	*tim-mer*

signified both a room or building, and the material, whatever it might be, of which it was constructed, and is used more frequently to describe stone than wooden construction. Wachter[†] gives the meaning "Materia unde aliquid fit." Junius[‡] remarks, "Constat materiam tam ligneam quam lapideam unde aliquid efficitur, *timber* appellari, immo metalla alemannicé *zimbar* vocari."

In the Old Norse, we read, "Slahans dör up eller hans *tymber* sönnar." "If they should burst the door, or break open the room."—*Stadga om Urbotomal.*

In the Gothic New Test, Ephes. ii, 20-2.—"Built upon the foundation of the apostles and prophets, Jesus Christ himself being the chief corner *stone*; in whom all the *building* fitly framed together groweth unto an holy temple in the Lord; in whom ye also are *builded* together for an habitation of God through the Spirit." Gothic—"*Ana-timridai* ana grunduvaddjau apaustaule jah profete at visandin auhumistin vaihstastaina silbin Xristau iesu; in thamma alla *gatimrjo* gagatiloda vahseith du alh veihai in fraujin; in thamma jah jus *mithgatimridai* sijuth du bauanai Guths in ahmin."

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[*] *Orig. Indo-Europ.*, I, p. 211.

[†] *Gloss. Ger. sub voc.*

[‡] *Gloss. Ulph.*

It is remarkable that the word *timr* is never employed in the Gothic language in the sense of wood. *Bagm* beam, *ans* beam, and *triu* tree, are uniformly employed.

In Anglo-Saxon, *timbrian, getimbrian,* to build, *getimbrung,* a building, are equally used to describe stone constructions. Mark xiii, 1—"Master, see what manner of *stones,* and what *buildings* are here." "Lareow! loca hwylce *stanas* her synd and hwylce *getimbrunga* thyses temples!"

As the German and English forests furnished the readiest material for ordinary building, the term *timber* naturally became mainly associated with wood, until it gained its present exclusive use. In the same way the French word *plancher,* which simply means the floor, became in English the word *plank* applied to the wooden boards of which a floor is with us usually constructed. The German term *zimmer-holz,* wood applicable for building, preserves a reminiscence of the original meaning of the word.

मा *má,* to measure, to parcel out

3rd Con. ÁTMANE.

Present *mime, mimishe, mimite*

2nd Pret. *mame*

Employed also in the sense of giving out—

इषे णो मिमीतम् *ishe no mimitam,* give us food.

Rigveda.

We have here, as in so many other cases, words in English descended from the same root by both lines of parentage.

Greek, *μέ-τρον*, a measure or rule, with its numerous derivatives
μῖμὲομαι, to take the measure of, to imitate
α-μο-τος, unmeasured
μέ-σος, middle
μή-νη, the moon, the measurer
Latin, *me-to*, *me-tior*, to measure
im-ma-nis, huge, unmeasured
me-nsura, measure
me-dius, middle
me-nsa, month
mo-dus, a measure
mo-dero, to keep within measure
hence *modestus*, *&c.*
me-ditor, originally to act or speak in a measured way, to exercise.

From this source, both direct and through the French, we have a large number of words; *measure*, with its various compounds and derivatives; *mediate*, *medium*, *immediate*, *&c.*, *meditate*, *modest*, *moderate*, *modulate*, *&c.*

In the Teutonic division we have—

Gothic, *mi-tan*, to measure
mi-taths, measure
ma-itan, to cut, divide
me-na, the moon
me-nath, month
mid-ja, middle
Old High German, *me-zan*, to measure
ma-no, moon
ma-noth, month
Old Low German, *me-ta*, *mani*, *manadi*

The Norse languages correspond.

Anglo-Saxon, *me-tan* *mo-na*, *mo-nath*, *mid-da*, middle
English, to *mete*, *moon*, *month*, *middle*, *mean*, *meet*.

Our word *meat* for food appears to be derived from the same source. On this word Horne Tooke observes, "In

Anglo-Saxon *mæt* (whatever is eaten) is the past participle of the Gothic verb *matjan* ; Anglo-Saxon, *metian*, edere, to eat. Dr. Richardson quotes Tooke and as usual adopts his etymology. The Gothic verb *matjan*, from the strict nature of Gothic grammar, is itself derived from *mat*, meat, and cannot have given rise to it. The Anglo-Saxon verb *metian*, *metsian*, which has its congeners in the sister languages, never signifies to eat, but uniformly "to deal out," to give to eat.* The words Anglo-Saxon *mete*, Gothic *mat*, *&c.*, are really the participles of the verbs *metan*, *mitan*, and signify not food in general, but that which is *meted* or dealt out at table. The same thing occurs in Sanskrit where मांस *mánsa*, from the same root, signifies caro, flesh.

There is every reason to believe that our word *mother* is derived from the same root. मातृ *mátṛi*, mother (*matar* in inflexion), is a noun of agency, formed according to the rules of Sanskrit grammar from the root मा *má*, and signifies a dispenser, dealer out. From thence it has descended into every branch of the Aryan family

Greek,	*μητηρ*
Latin,	*mater*
German,	*mutter*
Anglo-Saxon,	*meder*, *moder*
Swedish,	*moder*
Hollandish,	*moeder*

The Gothic being the only Teutonic language in which it is wanting, its place being supplied by the term *aithei.*

It may be remarked that this mode of forming the noun of agency by the addition of *ṛi* or *ar* to a form of the verb is identical with the mode still adopted in our own tongue; and which enables us, quite legitimately, to form new words from any verb which may be introduced into the language.

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* *Sax. Chron.*, 1013. "Tha bead he that man sceolde his here, *metian*, and horsjan." Then commanded he that his army should be fed, man and horse.

Ps. lxxx, 6. "Thu *metsast* us." Thou givest us food.

Almost every verb is capable of forming substantives in this manner. Help, help-er, think, think-er, run, run-ner, &c. So from the verb *mete*, in the sense of dealing out, the noun *met-er* is exactly equivalent to our word *mother*, which bears the same original meaning in a more antiquated form.

The other nouns of relationship are formed in the same way. Father, daughter, sister, brother, are all Sanskrit nouns of agency, formed upon verbal roots. Father is from पितृ *pitṛi*, corrupted from पतृ *patṛi* or *patar*, according to Bopp, which is derived from पत् *pat*, to defend, sustain.

Zend,	*patarê*
Greek,	*πατήρ*
Latin,	*pater*

By Grimm's law, the initial tenuis changes in the German dialects to the aspirate.

Gothic,	*fadar*
Old German,	*fatar*
Modern German,	*vater*
Swedish, Danish,	*fader*
Old Frisian,	*feder*
Anglo-Saxon,	*fadar*
Hollandish,	*vader*.

Daughter is, in Sanskrit, दुहितृ *duhitṛi*, or *duhitar*, derived from दुह् *duh*, mulgere, extrahere, and signifies literally milker or milkmaid. All the primary names of the family relations are derived from the office each sustained in the primitive household, and in a pastoral state of society the duty of milking naturally devolves on the young maidens of the family. This derivation has been doubted. Mr. Cockayne * says—"This appears to me very doubtful. In general in ancient times men milked: cattle that roam over unlimited pastures are very wild, and it was never convenient to send the maidens far from home. The word, also, is correlative, the maiden is not daughter either to the cow or to the family." This seems hypercriticism. Whatever construction we may put upon the fact, there can be no question either as to the derivation of *duhitar* from *duh,* nor of the affiliation of the term in most of the Aryan languages. A parallel case occurs in another family relation, the derivation of which is within our own tongue. *Wife,* originally *wif-man,* meant, as is well known, the *weaver,* in contradistinction from the husband, who was the *wæpn-man* or soldier, but although weaver to the family, the term became restricted in course of time to her conjugal relation, from the fact of the wife, in our sense of the term, being always, or usually employed in preparing the garments for the family. So, the daughters in our sense of the term, being the ordinary milk-maids, the *duhitar* became inseparably associated with the filial relation.

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* *Spoon and Sparrow, pp.* 118, 331.

Greek, *θυγάτηρ*

The Greek aspirate, by Grimm's law, becomes

Gothic,	*dauhtar*
Old Low German,	*dottu*
Swedish,	*dotter*
Danish,	*datter*
Anglo-Saxon,	*dohter*

The medial changes to the tenuis in the High German—

Old German,	*tohtar*
Modern German,	*tochter*

"Brother," Sanskrit भ्रातृ *bhrátri,* or *bhratár,* appears to be derived from भृ *bhri,* and signifies bearer or helper, an expressive term, as applied to the fraternal relation.

The Sanskrit "bh" is usually expressed by the Greek *φ*, and Latin *f.*

Greek,	*φρᾶτήρ*
Latin,	*frater*

The classic aspirate changes to the Gothic medial—

Gothic,	*brothar*
Old Low German,	*brodar*
Swedish,	*broder*
Danish,	
Anglo-Saxon,	*brothor*

In High German the medial is exchanged for the tenuis. Old High German *pruodar*, softened in Modern German to *bruder*. "Sister" is represented in Sanskrit by "*swasri*" or "*swasar*." The primary meaning is somewhat obscure.

स्वादु *swádu*, signifies pleasant, agreeable
Gothic, *sutis*
Latin, *suavis*
English, *sweet*

According to this the sister would stand to the brother in the relation of soother, consoler. Let us hope that this is a more probable derivation than the one suggested by Bopp, from स्व *swa* "suus," and सार् *sar* "femina," which has reference solely to the intimate family relation of the parties.

Latin,	*soror*
Gothic,	*svistar*
Old German,	*suestar*
Old Frisian,	*swestar*
Swedish,	*syster*
Danish,	*söster*
Hollandish,	*suster*
Anglo-Saxon,	*svuster*
Modern German,	*schwester*

Two of the roots already alluded to in these family relations have other English derivatives. From दुह् *duh*, to draw out, to pull, to milk, comes—

Gothic,	*tiuh-an*
Old Saxon,	*tioh-an*
Old Frisian,	*tog-a*
Old Low German,	
Anglo-Saxon,	*teon*
English,	*tug*, also *dug*, (for a teat)

The High German substitutes the aspirate for the tenuis and it becomes *zieh-en*, anciently *ziuh-an*, to draw or pull.

From the same root comes the Latin *duc-o*, the primary meaning of which is to draw.

> "Quo sequar, quo *ducis* nunc me?"
>
> *Plau. Bac.*, 3. 3. 2.

So the derivatives *ductilis, ducto, ductarius, &c.*, all refer to drawing rather than leading, which is the secondary meaning.

We have in English many words through this channel; *duct, ductile, ductility, conduct, con-duce, re-duce, &c.*

The root भृ *bhṛi* or *bhar*, from which *brother* is derived, has many other derivatives both in our own and the kindred languages.

Greek,	*φέρ-ω, φορέω, φόρος*
Latin,	*fer-o, fer-re*, to bear
	for-tis, that which will bear, strong
	fer-tilis, } bearing fruit
	fer-ax, }

Our derivatives from this classic source are not numerous, but we have *fertile, fertility, fertilize, &c.* According to the law so often quoted the radical becomes in Gothic *bair-an*, with a large number of compounds and secondary forms.

Old Saxon,	*ber-an, giberan*
Anglo-Saxon,	*ber-an*
Swedish,	*bär-a*
Danish,	*bær-e*

In the Old German, following the law, it is *per-an*, now softened down to *gebähren*. In all the languages it is also employed in the sense of bearing fruit, and bearing children. From the same source comes *burden*, that which is borne. As a secondary meaning it takes the sense of raising up, elevating; hence "*berg*" a hill, mountain; Anglo-Saxon, *byrian*, originally to raise up, from which our word to *bury*, now meaning to put in the ground, but originally to raise a mound or *barrow* over the deceased. A further meaning is that of protection connected with elevation; Anglo-Saxon—*beorgan*, to protect, fortify; whence *byrg*, *burg*, *borough*, a city, the early cities being usually placed on elevated sites for protection—

The Gothic,	*bringan*, *braht*
German,	*bringen*
Anglo-Saxon,	*bringan*

are also derived from the same root in the sense of carrying.

ध्रु *dhru*, to stand firm

6th class Parasmai *dhruvami*, *dhruvasi*, *dhruvati*

From this idea of standing firm comes the Greek *δρῦς*, oak tree; Cambri *dri*, oak, hence the term *dru-id* for the Celtic priests whose worship was connected with groves.

Gothic,	*triu*, tree
Old Low German,	*tre*
Swedish,	*trä*
Danish,	*træ*
Hollandish,	*tere*
Anglo-Saxon,	*treon*
English,	*tree*
Old English,	*treen*, made of wood
	trivet, a wooden bolt, now contracted to "rivet"

In this sense the term does not exist in the High German branch.

In the secondary sense of sure, certain, fixed, true, it has a wider range—

Sanskrit,	ध्रुव *dhruva*, certain, sure
Lithuanian,	*drú-tas*, firm
Gothic,	*trau-an*, to trust
	trau-ains, confidence
Old High German,	*truen*
Modern German,	*trau-en*, to trust
	treu, faithful
	trösten, to comfort, &c.

Old Low German,	*tru-a*
Old Frisian,	*triu-we*, *trow-a*
Swedish,	*tro*, faithful
	tro̊st, bold
	tro̊sta, to dare
Danish,	*troe*
Hollandish,	*trouw*
Anglo-Saxon,.	*treow-ian*, to trust, confide
	treow-fæst, faithful
	treowth, truth
	truw-a, a treaty

In English, we have from the root in this sense, *truth*, *true*, *trow*, *troth*, *truism*, &c., *truce*, *trust*, *tryst*, *trusty*, *trustee*, and their compounds.

Perhaps the wonderful fertility of a single root cannot be better exhibited than in one with which I shall conclude.

लुभ *lubh*, to desire, covet, allure.

4th class Parasmai *lubhyami*, *lubhyasi*, *lubhyati*.

The Greek possesses no remains of this root.

In Latin we have—

	lubens, willingly, with pleasure.
	lub-et, or *libet*, to be disposed.
	lub-itum, or *libitum*, at pleasure.
	lub-ido, or *libido*, desire, lust.
Lith.	*lûb-ju*, to desire.
Slav.	*liúb-iti*, to love.

The Teutonic tongues are the most prolific.

Gothic,	*liub-an*, to love
	liub-s, dear.
Old Low German,	*liuf-r*
Old Saxon,	*liof*, *lief*, *gi-lob-ian*
Old Frisian,	*liaf*
Hollandish,	*liev-en*, *lief*.
Old High German,	*liub-an*, *lieb-en*

Modern German,	*lieb-en*, *lieb-e*
Swedish,	*ljuf*, *lyuf-lig*
Icelandic,	*liuf-r*
Anglo-Saxon,	*lufan*, *leof-lic*

In English we have *love, lover, lovely, loveless, loveliness,* with various compounds. So far extends the primary meaning.

There is another group of words, the connection of which with this root is not so obvious, but of which the examination will reward research.

The derivation of the English word *believe* has hitherto been an unsettled question with etymologists. Its equivalents in the cognate dialects are as follow—

Gothic,	*laubjan*, *galaubjan*
Old High German,	*laubjan*
Modern German,	*glauben*, *er-lauben*
Danish,	*lov*, *love*
Hollandish,	*ge-loov-en*
Old Low German,	*leyf-a*
Anglo-Saxon,	*lyf-an*, *ge-lyfan*

Johnson simply refers the word to the Anglo-Saxon *gelyfan,* which is perfectly correct so far as it goes. Richardson enters into a much more elaborate inquiry. He says—"The etymologists do not attempt to account for this important word. It is undoubtedly formed from the Dutch *leven,* German *leben,* Anglo-Saxon *lifian, be-lifian,* Gothic *liban,* 'vivere,' to live or be-live, to dwell. *Live* or *leve* are used indifferently by old writers, whether to denote *vivere* or *credere.*" Amongst others he gives the following examples from *Robert of Gloucester*—

> "He *bi-leude* without the town, and in wel grete fere."

Here *bi-leve* is to *live,* or continue to *live,* to dwell.

In the following

> * * "hys soule for to amende
> That rygt *bi-leue* hym tagte and gef him Cristendom,"

the meaning is, taught him to *live* rightly; taught him a rule by which to *by-leve* or to *live;* and gave him Christendom or Christianity—made known to him the life of Christ, how he *be-leved* or *lived*—as told in the gospels of Christ.

In the following, from *Piers Ploughman's Vision*—

> "Werfore he het the elemens, to helf you, alle tymes
> And bring forth youre *bylive*, bothe lynnen and wollen."

"To bring forth your *bylive*," is to bring forth that by which you may *live*.

To *believe*, then, is—to *live* by, or according to, to abide by; to guide, conduct, regulate, govern or direct the *life* by; to take, accept, assume, or adopt as rule of *life;* and, consequently—to think, deem, or judge right; to be firmly persuaded of, to give credit to; to trust, or think trustworthy; to have or give faith or confidence; to confide, to think or deem faithful." So far Dr. Richardson.

I have made this extract at some length for the purpose of exhibiting the present condition of the science of English etymology; and the utter absence of sound principle in pursuing the inquiry. Where a word actually exists in Anglo-Saxon (which is only another name for the older form of our own tongue), the natural and obvious course would be to carry back the analysis as far as possible by comparison with cognate languages until a common root be reached from which the various forms have diverged, instead of which we find fanciful conjectures as to the origin, in a later age, of a word co-eval with the existence of the language itself.

The analogies relied on by Dr. Richardson are without foundation. The remark that "*live* or *leve, be* or *bi-leve,* are used indifferently by old writers, whether to denote *vivere* or *credere*" is not borne out by the examples given.

In the first passage given above, from Robert of Gloucester, "He *bi-leude* without the town, &c.," the word *bi-leude* is an inflexion of the Anglo-Saxon *belifan,* "to remain," and means, "he remained or stayed" outside the town, &c. Two other quotations given from the same author, present the same word with the same meaning.

The Scottish dialect still preserves a reminiscence of this verb—

> "*Belyve* the elder bairns come drapping in."
> *Cotter's Saturday Night.*

Chaucer uses the word in the same sense. In the "*Story of Cambuscan bold,*" Canace, recounting her sorrows, says—

> "Swiche harme I felt, for he ne might *by-leve*,
> So on a day, of me he took his leve."

A similar instance occurs in "*Troilus and Creseide,*" Book III, 624.

The corresponding term is found in the Gothic of the 4th century. 1*st Thessalonians, iv,* 15—

> "We who are alive and *remain*."
> "Veis thai libandans jah *bilaibidans*."

Also in Francic of the 9th Century—

> "Balo ther uns klibit
> Joh leidor nu *bilibit*."
> The evil (bale) cleaves to us,
> And the pain now *remains*.
> *Otfrid. Evang.*, Lib. II, ch. *vi*, 72.

In the quotation from *Piers Ploughman,* the word *bylyve* means sustenance, food and clothing, as in the following passages not quoted by Richardson—

> "And some he kennede craft and konnynge of sight,
> With sellynge and buggynge, hir *bilyve* to wynne."
> *Vision v,* 13425.

> "That thow toke to thi *bilyve*, to clothes and to sustenaunce."
> *Vision* 13939.

The word is from *bi-libban,* to live by, but has not the remotest connexion with *belief*.

In the second passage from Robert of Gloucester—

> "That rygt *bi-leue* him tagte, &c."

and in the remainder of the quotations the word is simply the modern *belief* disguised under the antique spelling.

The irregularity and uncertainty of mediæval orthography, frequently confounded words quite distinct in their origin and meaning. This was not that the same word was intended to be employed in different senses, but that words radically distinct, in the absence of any orthographical system, were frequently expressed by the same letters. In *Piers Ploughman's Vision,* the words *leven* to leave, *leven* to dwell, remain, and *leven* to believe, are all spelled alike, but that they are really different words, and not mere accommodations of the same expression, is evident from the fact of the preterite of the first being *lafte,** of the second *lefte,*† and of the third *leved, leveden.*‡

If Dr. Richardson were correct in his deviation of *believe, belief,* from *by* and *life* or *live,* i.e., that which we live by or the *by-life,* it must have originated since the use of modern English, as no such compound exists in Anglo-Saxon, whilst the actual word itself *ge-leafa, ge-leafan,* sometimes spelt *ge-lefa, ge-lyfan,* was in common use. The difference in the prefix between the Anglo-Saxon *ge-leufa* and the modern *be-lief* is unimportant. The same change has taken place with many other words; *bethink,* Anglo-Saxon *gethencan*; *betoken,* Anglo-Saxon *getæcnan; besmear,* Anglo-Saxon *gessmerian;* besprinkle, Anglo-Saxon *gesprengen.*

It may be remarked that the English words *belief, believe,* and their foreign congeners are purely Teutonic, no cognate terms being met with in any of the other branches of the Aryan family.

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* "For confort of his confessour contricion he *lafte.*"
Vision 14666.

† "There is more pryvé pryde
In Prechoures hertes,
Than there *lefte* in Lucifere."
Creed 743.

‡ "Tho that me lovede
And *leved* in my comynge."
Vision 12890.

Wachter derives the German form *glauben* from *lauben*, which he says, "Proprie est manu apprehendere, a *law*,* manus, et simile Attico λαβεῖν. Dicitur autem allegorice de fiducia, quia manus ab antiquo fidei datæ et acceptæ symbolum fuit."

It is sufficient to remark on this etymology that the oldest form of the German is *laubjan*, a derivative from another verb, and that the forms in the cognate languages of equal antiquity with the German, give no indications of the derivation to which he alludes.

Skinner derives the Anglo-Saxon word *geleafan* from the particle *ge*, and *lyfan*, to grant, allow, "concedere."

The origin and history of these terms may be briefly stated as follows. In the Gothic language, which is peculiarly valuable from its shewing changes in progress which are only found in their completed results in the sister tongues, the verb *liuban*, to love, makes its preterite *lauf, lubun*. From this, by adding the suffix *jan*, a secondary verb *laubjan*, with the usual intensive prefix, *ga-laubjan* is formed. This extends the original meaning of preference, desire, to that of trust, reliance, and then, of faith, belief. Thus in Luke xvi, 11, "Who will *commit to your trust* the true riches?" the Gothic version expresses it "thata sunjeino was izvis *galaubeith?*" Romans x, 11, "Whosoever *believeth* on him shall not be ashamed." Gothic, "wazuh sa *galaubjands* du imma ni gaaiviskoda." In this the Gothic follows exactly the πιστεύω of the original Greek, which similarly combines the two shades of meaning.

The Gothic *galaubjan* became contracted into the German *glauben*, and the parallel forms quoted above are merely dialectic variations. The double sense of trust and belief is well shewn in the following passage from the Anglo-Saxon version of the Gospels. Matthew ix, 2, "And Jesus seeing their

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* Scottish "*loof*."

faith, said unto the sick of the palsy, Son, be of good cheer, (Greek *θὰρσει,* Latin confide) thy sins be forgiven thee." Anglo-Saxon, "Tha geseah se Hœland heora *geleafan,* and cwœth to tham laman, Sa bearn *gelyfe,* the beoth thine synna forgyfene."

This derivation of *belief* from *love* is admitted by several recent etymologists of high authority. Gabelentz and Loebe and Diefenbach, place the words according to this derivation. Junius connects the English *believe* with Gothic *galaubjan,* but pursues the analysis no further.

It is difficult to resist the feeling of a close etymological connexion between the words *live* and *love,* German *leben* and *lieben,* Gothic *liuban* and *liban,* Anglo-Saxon *lybban* or *leofian,* and *lufian.* This resemblance runs through all the Teutonic languages. These forms with the exception of a few words in Latin are not found in the other branches of the family.

This connexion was not unperceived by our older philologists. Junius on the word *live* observes, "plures petierunt ex *lieben* amare, diligere, quod miseris mortalibus nihil vitâ carius." Should this speculation prove correct, that *live, love,* and *believe,* are derived from the same original, it gives a remarkable illustration of the simplicity of the ancient roots, and of their vital power in expanding and giving bodily form to the ever widening demands of the human mind.

I must here bring these remarks to a close. I have brought under notice a mere fragment of a wide field which lies open for exploration, and in which patient study will produce results of a very important nature as regards English etymology. When the study of the Sanskrit roots shall have been thoroughly and systematically worked out, the philology of the Aryan tongues in general will assume a character of accuracy and science which it has never yet attained.

In our own tongue this is peculiarly important. The English language, in one respect, may be said to be unique. We have seen that there are two divergent channels along which derivatives from the original roots have descended to modern times. I have called these the Classical and the Teutonic. Some roots have followed the one course and others the other; many have been transmitted to us through both. The mixed character of modern English speech has been sometimes represented as a defect, but there was never a greater mistake. The two streams, descending from long remote ages, have united on English ground, and nowhere else, and have imparted to our tongue a strength and vigour, combined with a richness and fertility, which have never been surpassed in the world's history, and which render it unrivalled amongst modern languages as a vehicle for thought. I shall be glad if any remarks of mine may have given an impulse, however feeble, to an inquiry of the most interesting character, and which will well repay research.

At the conclusion of this paper a vote of thanks was proposed by Mr. Birch and seconded by Mr. Danson, (who referred to the valuable Sanskrit collection in the Free Public Library, the credit of which was due to Mr. Picton,) and carried unanimously. Dr. Ginsburg made some supplementary remarks upon the analogy of some of the roots mentioned by Mr. Picton and those of oriental tongues.

FIFTH ORDINARY MEETING,

Royal Institution, December 14th, 1863,

JAMES A. PICTON, Esq., President, in the Chair.

Messrs. R. D. Holt, Robert Erskine, Rudolph Zwilchenbart, junr., and Theophilus Ashe, were balloted for, and duly elected members.

It was announced that Mr. S. H. Behrend, M.A., had accepted the post of Librarian, and he was requested to prepare a catalogue of the books in the library as soon as possible.

The **President** stated that, thinking it would be interesting to the society, and through the society to the public at large, to have brought before them objects of interest acquired from time to time by purchase or donation for the Free Public and Derby Museum, he had laid such a proposal before the Committee, who gave it their cordial approval. Mr. Moore had, in consequence, brought, as an instalment, some remains of the great fossil cave-bear (*Ursus spelæus*). Of this gigantic extinct beast the skull and under jaws, the greater part of the vertebræ and of the bones of the limbs, as well as ribs and phalanges, had lately been obtained by purchase, from Arriège, in the south of France, forming a most important addition to the Palæontological collection, on account of the great interest attaching to it in connexion with the question of the antiquity of man. Mr. Moore also exhibited some nests of weaver birds, (*Ploceus baya ?*) from Burmah, recently presented, with other specimens, by Captain Major, of the ship Norway.

A specimen of Comatula, and a series of Gorgoniæ, or sea fans, from the collection of Mr. I. O. W. Fabert, were exhibited by that gentleman. They had been recently obtained in twenty fathoms water, in lat. 0.30 N., lon. 105.14 E., near the island of Linga.

Mr. Moore stated that he had compared the Comatula with the most recently published list of species, but could not at present satisfy himself with its identity with any therein enumerated. The series of Gorgoniæ consisted of exceedingly beautiful specimens of several distinct species, of which no examples existed in the museum.

DR. COLLINGWOOD communicated some experiments of M. Thury, professor in the academy of Geneva, who has made a discovery, which, if it be corroborated, will be one of the utmost value in the farm and homestead. He has arrived at a formula for obtaining cattle of either sex *at will.* It is necessary to exclude from the experiment those animals in which the signs of heat are vague and uncertain, as is observed in fat cattle and confined individuals; but healthy cows, and those living in the open air, must be used for the purpose. The experiments made upon cattle at Montel, appear to have been decisive, if we may judge from the following results:—"In the first place," says the breeder, "in twenty-two successive cases I have sought to obtain heifers; my cows were of the Schwitz race, and my bull pure Durham blood. I obtained the result sought for in *every case.* Having later purchased a Durham cow, I sought to obtain a pure Durham bull calf, and succeeded, and have since obtained six other bulls, crossed between Durham and Schwitz. Altogether I have made twenty-nine experiments, and every one has given the result sought." The importance of such a law will be evident, and especially will such results be valuable in countries where it is desirable to obtain oxen for working purposes; as in others, cows are the most valued animals. Moreover, the same remark will apply to sheep.

DR. COLLINGWOOD exhibited a photolithograph by the process Marquier, of Paris, and explained the manner in which it was obtained.

A paper was then read, of which the following is an abstract:—

ON LONGEVITY IN ENGLAND.

BY THOMAS BALMAN, M.D.

AFTER some general remarks on the great interest manifested in very old people by all classes, and that they had long been regarded as the special *protégés* of crowned heads, he said—At page 102 of any volume of the Registrar-General's reports of the births, deaths, and marriages, we find recorded the deaths occurring in England at different ages, from the first year of infant life to the age of 95 and upwards : the last column also includes the deaths of persons who had either attained or exceeded the age of 100 years. The place where these deaths were registered is marked by an asterisk, and the precise age specified in a foot note. These he had collected together, and tabulated in such a way as to show how these deaths were distributed throughout the different towns and registration districts of England during a period of six years from 1855-60. The sum of deaths of centenarians during this period was 501 ; 157 males and 344 females, the average being 83. This was about the same proportion as France. Thus England, with a population of 20 millions, gave an annual average of deaths at the age of 100 and upwards of 83 persons which was 4½ to every million of its inhabitants. France, with a population of 36 millions, gave an annual average of deaths at the same age of 148, which was exactly 4·111 to every million. It was generally believed that about one in every 10,000 attained the age of 100 years. His own calculations gave somewhat different results, and seemed to show that there were about two centenarians to every 10,000 deaths. For example, in six years, 1855-60, the sum of deaths registered in the metropolis was 366,581 ; of these, 50 had either reached or exceeded the age of 100, giving 1·909, or say 9-10ths, very nearly two persons to every 10,000. Within the same period the sum of deaths registered for the whole of England and Wales was 2,549,182, and 501 had attained the age of 100 years; and, singularly enough, the result was the same, 1·9-10ths, or almost two persons to every 10,000 deaths.

Taking a period antecedent to this we find a higher ratio. In ten years—1831-40—the deaths registered in London were 348,018; of these, 24 were males and 55 females, making 79 persons who had survived to the age of 100, giving 2·270 to every 10,000, or a little over 2¼. In 30 years—from 1728 to 1758—the deaths recorded in England and Wales amounted to 750,322, and 242 were registered as having attained the age of 100, giving 3,225 to every 10,000, or say 3¼. Taking, therefore, a given number of deaths in the present and past centuries, without regard to time, the inference is that more people lived to be very old in the last than in the present century.

The census of the people lately taken confirms this supposition, as, notwithstanding the increase of population, the census of 1861 returned only 201, whilst that of 1851 gave 215 persons who had survived to the patriarchal age of 100 years.

Having seen the number of deaths of centenarians, the reader of the paper proceeded to portion them out over the different parts of England and Wales in the following way:—1st, into divisional counties; 2nd, counties; and 3rd, into districts and sub-districts. This part of the subject was illustrated by a series of tables, for which, from their great length, we are unable to find room. We, however, subjoin the first. It shows how these 501 centenarians are distributed over the 11 divisional groups of counties into which England is split up for registration and other purposes.

DEATHS OF CENTENARIANS IN DIVISIONAL COUNTIES, ARRANGED ACCORDING TO POPULATION.

	Male.	Female.	Total.	Population 1861.	Proportion to Population.
Welsh	30	59	89	1,312,834	1·14,750
Eastern Counties........	18	27	45	1,142,480	1·25,388
South Western do.	20	48	68	1,835,714	1·26,995
Northern do.	16	23	39	1,151,372	1·29,522
West Midland do.	13	56	69	2,436,568	1·35,312
South Eastern do.	14	24	38	1,847,661	1·48,622
London	17	33	50	2,803,989	1·56,079
North Midland Counties..	8	14	22	1,288,928	1·58,587
North Western do.	10	33	43	2,935,540	1·68,268
South Midland do.......	6	12	18	1,295,597	1·71,977
Yorkshire..............	5	15	20	2,015,541	1·100,777
	151	344	501		

The divisional counties returning the largest number of centenarians, and therefore most favourable to longevity, are Wales, North and South, returning 89, or one centenarian to every 14,030 of its inhabitants. The difference between the three next groups of English counties is slight; nevertheless, it is somewhat remarkable that the eastern division, embracing as it does immense tracts of flat marshy country, and in no great repute for its general salubrity, should take the palm from all the others for the superior longevity of its people. With regard to the three divisions that absorb very nearly one half of the whole population of England and Wales, viz, London, with the metropolitan portions of Surrey and Kent, Lancashire and Yorkshire, it is curious that London, with its huge and pent-up population, should compete so successfully with country districts, where the inhabitants are scattered, and therefore in a condition better calculated to prserve health and to prolong life. It seemed to imply that crowding or agglomeration of individuals, as seen in large cities, is not unfavourable to extreme longevity.

With regard to the next table, No. 2, which showed the number returned for each separate county, it would be observed that the healthiest counties were not always those that returned the greatest number of centenarians. Heading the list, for example, was Lancashire, the county giving the highest death rate in England. At the bottom was Westmoreland and Rutlandshire, with a low death rate, and therefore among the most healthy of our counties. In the rear also was Northamptonshire, abounding in beautiful scenery and pastures, and containing more seats of the nobility and gentry than any other county. The two last did not return a single instance of a person dying at the advanced age of 100 years within the period before mentioned. The fewest centenarians were principally found in the north and south midland counties, and north-west of London. They were with few exceptions fine agricultural counties, and considered extremely healthy. Starting with Middlesex, we have Hertfordshire, Bedfordshire, Buckinghamshire, Oxfordshire, Northamptonshire, Huntingdonshire, Cambridgeshire, Leicestershire, Rutlandshire, Nottinghamshire and Derbyshire.

The counties giving the largest number of centenarians are, for the most part, in a position directly west of those above named, commencing with that peninsular tract of our sea-girt isle whose shores are washed by the Irish Sea. We have South Wales, Herefordshire, Monmouthshire and Somersetshire, then follow the two eastern counties, Norfolk and Suffolk, with North Wales. The counties next in order most favourable to longevity are the two northern, Northumberland and Cumberland, taking precedence of *three* of the *five* south-western counties, viz., Cornwall, Wiltshire and Devonshire.

From counties this little band of remarkable people were followed into minuter divisions of teritory comprised in what were called districts. The 44 registration counties were subdivided into 623 of these districts. They were collections of contiguous parishes or places, and were generally identical with the poor-law unions of the same name. The following analysis, for reasons explained, were mainly confined to town districts:—

Beginning with London, it was found that the majority of centenarians were stowed up in the worst parts of the metropolis. Whitechapel, which comprised the Artillery, Spitalfields, Mile-end, Old Town, with a population of 78,470, and having a death rate of 29 in 1,000, in 1862 returned the largest number. East London, embracing St. Botolph and Cripple-gate, the most densely populated part of the metropolis, with only 17 square yards to each person; the City of London giving 31, and St. George's, Hanover-square, 79 square yards to each individual, returned 4 centenarians; Bethnal-green, 2; Marylebone, 2; and Lambeth, 3. The fact of so many old people having been found in these parts of London clearly showed that they must have been in a very humble position, and in many instances were probably paupers or mendicants. Some might have resided on the banks, inhaling for half a century or more the sweet perfumes of that much abused river the Thames.

Liverpool told very much the same tale. This district, as defined by the Registrar General, is known as the Parish of Liverpool, and included St. Martin's, Howard-street, Dale-street, St. George's, St. Thomas's, Mount-pleasant and Islington. It has necessarily a very dense, and in some parts of it a most foul population, and any one at all acquainted with the filthy and ill-conditioned state of some of the courts and alleys in which a large proportion of the working and lower orders lived would scarcely be surprised to hear that the deaths had in several cases much exceeded the births. Was it not remarkable, under such circumstances, that Liverpool should return 8 centenarians, whilst the West Derby district, which included all the out-townships, which were pleasantly situated on the slopes and heights of the surrounding hills, and inhabited, for the most part, by the well-to-do classes, should not give a single example of a centenarian within these six years? Exeter returned 4, whilst the Newton Abbot district, including Teignmouth, Torquay, Newton Ashburton, and with twice the population, and having a climate singularly mild and genial, gave only 1; and Plymouth, with 76,000 inhabitants, did not present a single instance.

There is one locality in England that contributes more to swell the list of old people than any other, and we could not refuse to regard it as the district the most generally favourable to longevity in our island. It is the estuary of the Severn and immediate vicinity of the Bristol Channel; on one side of it we have Somersetshire and Gloucestershire returning 43, being more than twice the average of the other English counties. The average for the forty English counties was about 10½ to each county. The districts returning these deaths are Clifton 6, Bristol 2, for Gloucestershire; and Taunton 6, Bath 6, Bridgewater 4, in Somersetshire. On the other side of the channel we have two Welsh counties giving 33, Glamorganshire 22, and Monmouthshire 11. The districts returning these deaths are Merthyr-Tidfil 6, Neath 4, Cardiff 4, Swansea 3, Abergavenny 7. All these places are within a few miles of the Bristol Channel, and are among the most important iron and coal districts of South Wales. Carmarthen returned 4, Llandovery 3, and at the extreme west of the county of Pembrokeshire we have the ancient city of Haverfordwest giving 6.

SIXTH ORDINARY MEETING.

Royal Institution, 11th January, 1864.

JAMES A. PICTON, Esq., President, in the Chair.

Dr. Collingwood announced that the first list of the Committee for carrying out the Shakspeare Tercentenary Festival had been completed. He read the list, which included nearly seventy of the leading literary, scientific and commercial names of the town. He also stated that this Committee would meet at the Town Hall on Monday next to initiate arrangements.

Mr Bailey exhibited a drawing of the recent meteor, with a description from the pen of Mr. Alexander Herschel.

Mr. Moore exhibited a stuffed specimen of the short sunfish, *Orthagoriscus mola*, presented to the Free Public Museum by Captain E. Johnson, brig Ringleader. This fish measures five feet in total length; is three feet high, or measuring from tip to tip of dorsal and anal fin, six feet six inches. It was captured on the 15th of September, 1863, in lat. 49° north, long. 9° west, by Captain Johnson, whose attention was first drawn to it by seeing it "fly about twelve feet forward out of the water." It afterwards appeared to be floating on its side, skimming the surface, probably feeding on the jelly-fish, which were very plentiful, and remains of which were subsequently found in the stomach. A boat was lowered and the fish harpooned, but it was with difficulty towed to the brig, for only when the fish lay on the surface of the water could the boat make way; when it could assume its vertical position beneath the surface the boat was towed by the fish. The flesh was well flavoured, resembling codfish. Above three quarts of oil were extracted from its liver. The occurrence of this species in British waters is sufficiently rare to be worthy of record.

Mr. MOORE also announced the addition to the museum of living specimens of the following species of fish from New York, viz.:—The fresh-water sunfish, *Pomotis vulgaris*, a pretty species, common in ponds; a species of catfish, *Pimelodus pullus*, with eight long sensitive feelers projecting from the snout and chin; and the sheep's-head lebias, *Lebias ovina*, a diminutive salt-water fish. They were imported and presented by Captain Mortimer, of the ship America, on whom the society had already conferred its honorary degree of *Associate*, for his zeal in the cause of natural history.

A paper was then read, entitled

A VISIT TO SALZBURG AND THE SALT MINES OF HALLEIN.

By R. HIBBERT TAYLOR, M.D.

The following paper was also read:—

ON VITALITY.

By the Rev. H. H. HIGGINS, M.A.

There is at present amongst some very eminent physiologists a growing tendency to deny, or at all events to question, the existence of vitality as distinct from the action of known forces, such as heat, light, electricity, &c., or something analogous to these.

The views of the physiologists above referred to may thus be briefly stated :—

(1.) Of the nature of vitality we know nothing; we are therefore not required either to admit or to deny its existence as a distinct thing.

(2.) The observed phenomena of life are consistent with, and, to a very great extent, derivable from, the operation of known laws: it is therefore not philosophical to introduce an entirely unknown agency to account for such residual phenomena as are not thus reducible.

The present paper will be devoted to the consideration of some questions bearing upon these two propositions.

It is a matter of comparatively little importance what term may be chosen to denote the object of our enquiry, whether it be "vitality," or "germ force," or the "vital principle," so that it be clearly understood to refer only to the ultimate element of life, and not to any even of the simplest functions of life. Seen under this aspect, vitality is simply the *sine quâ non* of the animate individual,* whose very existence as such, stands or falls as vitality is, or is not, regarded as a distinct entity. Personality, which is a higher form of individuality, is equally dependent on the question whether vitality is, or is not, the result of forces such as we are accustomed to deal with in scientific investigations. It would be absurd to call a flame a person or an individual ; yet it has active qualities, a distinct form, requires aliment, &c. A man is not a person because he has these properties, but because he has a something which a flame has not. Whether this something be designated soul, or spirit, or will, or intellect, or vitality, is, I apprehend, all the same in respect of its relation to physical science, which cannot recognise metaphysical distinctions. In fact it is the question before us, whether on grounds of physical science we are competent to recognise vitality under any aspect as a distinct thing.

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* In assigning this position to vitality the writer is aware of the difficulties which beset the subject, especially in connection with the development of plants, and in respect of the lower forms in the animal kingdom, compound animals, the alternation of generations, &c. If, however, vitality can be shown to lie beyond the range of scientific investigation, in all these cases the knot is cut; and whilst physical development remains in every instance a proper object of scientific enquiry, neither the relations subsisting between the vitality of a seed and that of the parent plant, nor any similar relations, can adequately be discussed as matters pertaining to natural science.

It must be evident that if the vital functions by which man is distinguished from a block of granite be the result of difference in the combination of the primary molecular forces of his living substance, he has no more right to be regarded as a person than has a thunder-storm ; his being is a process, and in general terms he may be described as a segregation of certain forces, initiated by a similar combination, and passing away into equilibrium, or into the general stock from whence he was derived.

The issue, however, must be tried not on its consequences, but on its scientific merits ; on which grounds, as I apprehend, whatever may be demonstrated concerning the vitality of man holds equally good with reference to the life of a monad, or of a particle of red snow. Still, if it can be shown on purely physical principles that vitality is a something which is not analagous to the actions of known forces, then life is, to all intents and purposes, a miracle, by which I understand not the action of a power in opposition to, or thwarting the physical laws of nature, but the manifestation of an agency extracosmical, working harmoniously with, and by means of, those laws.

It may seem to some hardly worth the while to contend for the possession by man of a distinct vitality, if by this term is meant only that which he must hold in common with an animalcule or a seed. But a moment's reflection will make it plain how vast a step is taken if we gain from science the admission that her kingdom is not universal. None will be more ready than the man of science to confess how little is that which is known, when compared with that which still remains to be known; nevertheless he is becoming more and more inclined to be convinced that all is *knowable*, and if known would be found conformable in all respects with the knowledge that he has already. So strong is this tendency that he is encouraged to entertain as possible, or even probable, theories that otherwise he would at once have rejected as monstrous and absurd—for example, the derivation even of the most exalted faculties of man, through a long series of almost insensible gradations, covering a period of millions of years, from ordinary forces which initiated the lowest forms of life. Now, if it can be shown that vitality, even in a vegetable cell, is a thing which lies beyond the scope of scientific investigation, the spell is broken, and a claim is established for the determination of what may or may not constitute the higher faculties of man, on other grounds than those of physical science alone.

As a believer in something more than natural science, it is proper for me to state that I do not think a rational persuasion of the personality of man must rest upon evidence to be obtained from physical researches. Still I should expect to find in science some indication of its own limits, and of the commencement of that border-land which separates the known from the unknown. More than this the very nature of the case forbids.

We may now proceed to the consideration of the two propositions given at the commencement of this paper as expressing the views of certain physiologists who decline to recognise in vitality anything beyond the operation of forces amenable to scientific investigation.

It will be observed at the outset that much stress is laid upon the absence of all knowledge respecting the *nature* of vitality. This limitation is needful, because to say that nothing is known of its effects would simply be to anticipate the decision of the question at issue. But it may at once be admitted that we know nothingof the nature of vitality. How should we, if it has no analogy with any of the known forces? For on this supposition, in what form could knowledge of vitality hold its place in our minds? Not in any of the old familiar forms, such as predicates respecting its quantity, intensity, polarity, and the like; for the thing thus known would have analogy with known forces, and would not be a thing *sui generis*, but would fall naturally into some recognised category. We have to give our reasons for concluding that certain observed facts imply the existence of an agency quite unlike any of the forces known to us. The reply that we know nothing of the nature of such an agency is certainly no disparagement to our hypothesis, unless it may be shown that nothing can exist of which we do not know the nature. If, then, we are at liberty to make the supposition that vitality is a thing *sui generis*, that we know nothing of its nature tells neither for nor against the probability of its existence.

One of the broadest generalisations deducible from the immense additions recently made to the ascertained truths of science is, that numberless things previously supposed to be distinct, are now found to be so closely related that it is impossible to draw a line of separation between them. This has been the case alike with things organic and inorganic. The great kingdoms of animal and vegetable life pass quite imperceptibly the one into the other; and in both kingdoms the number of classes, orders, families, genera, and species, that show the same tendency is so great that where an isolated group is found it is thought to be probable that the links of connection are missing only because they are extinct, or are not yet discovered.

It is important for our purpose to notice the manner in which one group of living things passes into another. It will generally be found that the transition is not effected by the shading off or blending of the extreme edges of the groups, but by a kind of interlocking of the one into the other. The junction often resembles that of the sea and the land on the coast of Norway, where in many places it is hard to say whether it is the sea that runs far into the land, or the land that runs far into the sea. Thus, judged by one set of characters, an organic form may not only be a vegetable, but even hold a somewhat high place in the vegetable kingdom, whilst, judged by another set of characters, the same creature may not only be an animal, but have its place by no means on the confines of the animal kingdom.

Discoveries relating to the allotropic forms of matter and the correlation of the imponderable forces, warrant the same conclusion as to the close affinity subsisting between inorganic things.

In fact, that "nature does not proceed by a leap" might seem to be a rule that lacks the criterion of an exception; yet there is an exception, and a striking one; limits have given way in all directions, yet there is one that stands out as sharply and as distinctly as ever; that, namely, which divides animated things from those which are inanimate. No form of matter that is not animate exhibits anything approaching to the phenomena of life. Of course, none but a superficial observer would suggest the process of crystalization, or the dendritic appearances of some metals, or the moss-like forms seen in agates, as exceptions. Neither can any instance of a degradation towards the character of inorganic matter be found in the very lowest forms of life, in the protozoa, or the sponges, or the nullipores, or the fungi, the algæ, the confervæ, or even in the single living vegetable cell.

Now, if the vital principle be analogous with any known form of matter or force, this solitary case of a great leap taken by nature is incongruous with all that we know of her other proceedings. If, indeed, the presence of life indicates the introduction of something entirely new, then we have a reason for the leap. But if not, the facts we have considered appear to be inconsistent with the hiatus between animate and inanimate things. If life be made up of forces similar to those which act in various ways both on organic and on inorganic matter, we might expect to find the transition from things inanimate to things animate the same in character with all other transitions in nature : the border-land would be occupied with semi-animate materials, and semi-mineral vegetables or animals, with instances of equivocal life, and products of doubtful organisation. Whereas, from the highest to the very lowest organism, even to the primordial utricle and cell, the phenomena of life are distinct and unquestionable. It is true that geologists have to deal with certain forms of doubtful organisation, found in the lowest rocks, but in these instances the difficulty arises from the changes through which the fossils have passed. There may be reason to doubt whether certain appearances truly indicate organic remains; but there is nothing to indicate that life, in the Silurian ages, was less distinct than it is now.

The above argument for the speciality of the vital principle, derived from the unparalleled solution of continuity in nature just at the point where life commences, demands, for its full illustration, rather a volume than a mere notice in a brief paper. Its force, if it have any, is evidently acquired from facts revealed by the very researches which have led some to form an opposite conclusion.

Again, if vitality is analogous to, or correlative with, the known forces, we might expect to find at all events some resemblance existing between their respective properties and modes of action. Now the results of the action of heat, electricity, chemical affinity, &c., on various forms of matter have been much studied, and a good deal is known about them. Yet among all these results no single instance can be found resembling the commencement of the functions of vitality. It is, however, admitted that from the outset the vital principle works harmoniously with and by means of the known forces; so that much of that which was wont to be ascribed to vital force is now known to be a chemical process brought about by the agency of light and heat. But the question is not what light, heat, &c., and vitality can do conjointly, but what light, heat, &c., can do without the presence of vitality, and the reply must, I think, be unfavourable to the correlation which is supposed to exist between vitality and the known forces.

It may be replied that none of the imponderable forces has ever been alleged to be the force of life; yet if the latter force is correlative with any of the former, could it behave so differently? For example, the known forces act universally: there is no kind of matter that is not at all times affected by heat, light, electricity, and chemical affinity: on the other hand, the force of life stops suddenly and definitely at a limit which excludes a large proportion of existing matter. Take any one of the known forces—heat, for instance; heat has no zero, but from the lowest to the highest temperature its intensity increases uniformly: heat has been compared with vital force because, as it is said, when of sufficient intensity, heat produces motion. But surely it should rather be said that at all temperatures and amongst the particles of all bodies heat *is* motion, and that this motion, inconspicuous at a lower temperature, simply becomes visibly manifest when a state of incandescence is approached. There is nothing in vitality answering at all to this. Let us turn to the correlative of heat, magnetism, which, like heat, is universally present, and has no zero—which, like heat, is capable of producing conspicuous motion, when collected in sufficient intensity—which, in short, in so many ways resembles heat, that the correlation of the two, now that it is known, seems obviously probable. So also of the other known forces; but not so of the force of life, which has a true zero, which does not act universally, which, in short, so little resembles the imponderable forces that their correlation cannot but be regarded as antecedently extemely improbable.

We may now pass again to the alternative: if vitality be not *sui generis*, it must be something analogous to the agencies with which we are acquainted. Now of these agencies collectively, the *most certain thing* that we can say is that they are strictly obedient to fixed laws: that under similar circumstances similar results invariably follow. So precise and constant is the operation of this rule, that, under favourable conditions, we are able to infer the antecedent from the knowledge of the effect, with as much accuracy as we can predict the effect from the knowledge of the antecedent. We are quite certain that no portion of a result, however minute, can have been produced without a corresponding character having existed in the antecedent. It is not contended that we are able to trace otherwise than very imperfectly the remoter antecedents of the facts observed in inanimate nature, but we are convinced that everywhere the supremacy of law is absolute.

If, for example, we could trace the history of a drop of water which trickles down the window pane, we should find that its volume, its direction, its temperature, and all its other characters were derived from atmospheric and other agencies: and if the history of the drop could be submitted to a suitable kind of examination, it would yield up to us the exact qualitative and quantitative characters of all the forces which had collected it and sent it on its course. These forces would indicate their antecedents, till it might be seen that our drop was the inevitable and exact result of meteorological and chemical and mechanical changes and actions that had been going on continuously from the Silurian ages and for we know not how long previously.

Nor would the whole history of the drop, however remote its starting point, present any very complicated or difficult facts. Some of its particles may have come from the antipodes, or have belonged to the polar snows; others, in a state of decomposition, may have assisted to lift a balloon or have been breathed by an icthyosaurus, yet they were never for an instant beyond the grasp of those known laws which in the end brought them together to be a drop: every step in the whole course being, with the utmost precision, dependent upon the previous one.

Those who do not admit the vital principle to be a thing *sui generis* must assign to it a place under the dominion of laws, the rigorous character of the operations of which I have endeavoured to illustrate.* If the consequence of such an allocation can be shown to be difficulties unparalleled in magnitude, something will be done towards proving that the allocation is a wrong one, and that the vital principle is a thing not subject to the laws of ordinary forces.

Such difficulties arise in various directions when we begin to apply the laws which govern things inanimate to the phenomena of life.

It is well known that the common Hydra may be reproduced by a small portion of its body severed from the rest, or even by a portion of one of its tentacles. On the supposition that known forces, or forces analogous to these, are alone concerned in this reproduction, it follows that in the severed portion must have existed physical peculiarities corresponding with *every part* of the entire animal: or, in other words, that the prototype of the perfect form to be evolved must have been in the particle capable of being thus developed. For known forces have no specific predilections of this kind, and except the bit contained that which could initiate the development in a particular direction, there is no conceivable reason why these forces should develope it into a Hydra, more than into an Amœba or a Rotifer.

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* Be it remembered, once for all, that on this point there can be no playing fast or loose to suit the occasion. Vitality is, or is not, subject to the exact laws of nature.

On similar grounds the seed must contain the perfect initium of the future plant to its most minute organs. The colour spot on the petal of a Pelargonium could in no conceivable way have been produced through the agencies of chemical affinities, heat, electricity, and the like, except from the existence of some corresponding physical starting point in the seed. This is admitted by some who question the existence of a vital principle; and one of them, Mr. Lewes, has attempted to show the mechanical conditions of the embryo under which the serrated leaves of certain plants are produced.

On the other hand it may freely be admitted that if this wonderfully complicated structure did exist in the seed, it is by no means certain that we should be able to discover any traces of it. Our being unable to find it is no proof that it may not be there, unless we can show that in our investigation of the seed we have detected the ultimate forms of matter.

Here it is important to define what is meant by the existence, in the embryo prototype, of a structure corresponding in all respects with the future animal or plant to be developed. It is not contended that in the seed, for instance, the prototype must fix in every respect the form and dimensions of the future plant; for in the course of growth the plant is submitted to the variable influences of heat and moisture and light, and these will affect its ultimate condition, or it may suffer distortion from the attacks of insects or from mechanical pressure. Still, under all these possible influences every portion, every fibre of the living plant will be what it would not have been but from some peculiar character in the seed which initiated its production.

There is not a leaf on an oak tree but must have had its own share in the acorn from which the tree sprang. For let us remember we are trying the consequences of the utter exclusion of vital force as a special thing; we have only to do with the results of the actions of known forces, which have no more tendency to produce a leaf than to produce an animal, except from the direction given to their energies by the original initium. In the action of these forces the result indicates the antecedent, as much as the antecedent the result. It matters not how many steps backward we have to go. The leaf takes its character from the bud, not, let us remember, by the influence of a vital force, but by a process of development brought about by heat, electricity, light, moisture, carbonic acid, &c., &c., acting on the bud. Then, I submit, the leaf in all its parts, down to its veins and stomata, must have been initiated by some special physical character in the bud. What have heat, electricity, &c., to do with forming veins and stomata? Given the proper nucleus, these forces are quite competent to develope any number of organs, but no particle of the leaf must fail of having had its type in the bud, else, instead of that particle, there would have been an hiatus, or something of a different kind.

The bud imposes the same conditions on the twig: but, in fact, the conditions multiply as we recede; for the twig has to furnish the starting points for the bud and all its leaves:

the twig, in like manner, looks back to the bough, till by the time we arrive at the acorn, it is useless to attempt to burden the mind with thinking of all its little shell must contain. Yet we have only gone back a single generation. That acorn was itself borne on an oak, which sprang from an acorn, which must have held the type of the types in the second acorn, and of every leaf of the tree which the second acorn produced. In fact if we conceive the oaks of the world to have sprung from a single acorn, on the hypothesis of those who deny the speciality of the vital principle, that acorn must have had in itself the types of all the oaks that have ever been produced. For agencies like those of electricity, heat, &c., can only work upon what they find; and if there should be a bud on the last oak that had not its representative in the first acorn, that bud would be a result without a corresponding antecedent.

Let us remark that the difficulty we here encounter arises from the peculiar manner in which life is transmitted from living things to their successors. No difficulties of this kind met us in the history of the drop of water, though we saw that it had a history reaching back to the very limits of time. Its particles may have been many times round the world; some of its parts may have been ice, or steam, or free oxygen and hydrogen. The changes they may have passed through quite exceed our calculation, but they were either chemical or mechanical: and though the series is long, the terms are simple—there is no accumulation of difficulty. In the case of crystals the nucleus is the requisite initium, or rather the molecules of the mineral substance have characters sufficient to determine the form of the crystal. But the crystal is homogeneous, and has no special organs such as are possessed by plants and animals. The production of such an organ as the eye from the mere development of physical peculiarities pertaining to the germinal vesicle and spot, can hardly be conceived to be possible.

In fact, the notion that every seed contained the perfect plant in miniature belonged to a former age, and has long been regarded as exploded; yet it seems to me to be an inevitable conclusion, if no forces are concerned in the germination and subsequent growth of the seed, but such as are of the nature of light, heat, electricity, &c. It is, however, certain that the seed possesses vitality; and without attempting to define what the vital principle may be, it appears reasonable to assign to it a certain special directive agency, by virtue of which it is enabled to apply the ever present forces of heat, actinism, &c., in the construction of a plant of its own proper species. But it is manifest that a vitality thus endued cannot be correlative with any of the known imponderable forces.

Another point worthy of attention is the stability of form and structure observable through many generations of the same species. Whatever may be the wondrous exactness of the embryo prototype, the accidental influences of heat, moisture, light, &c., in the course of growth are so great that it is hardly possible to conceive that, with *only* the physical character of the embryo (itself produced under these varying agencies) to determine the succeeding form, similarity should be preserved through so many ages and in so many collateral lines of descent.

The termination of life, on the supposition that the vital principle is analogous to known forces, ought to yield indications of some kind or other. Death is a common event, and one that lies completely open to observations of all kinds. In the animal world it is in our power to produce death under almost any conditions we may choose as most favourable for investigation: and it is an event so interesting that the discovery of its nature would be considered the greatest acheivement of the intellect of man. Yet the nature of death is absolutely unknown: the most delicate tests for indicating minute changes in electrical, thermal, and other conditions have been applied at the moment of death, and have shown no sign. Now it is certain of the forces of heat, light, motion, &c., that they are absolutely indestructible: they may be converted one into another, but they cannot cease to exist. If the vital principle was analogous to these agencies it might escape in any one of them; but of this no well ascertained trace has been observed in any investigation of the phenomena of death.

The uniformity of the period through which life extends in any given species is a result that no one would anticipate if the vital principle be of the nature of the known forces. The physical elements of animals are said to undergo an entire renewal in the course of a few years. Surely, then, with renewed materials to work upon, and with something akin to the imponderables to do the work, animals should never grow old. Why should they—any more than oxygen should lose its vigour and grow tired of uniting with hydrogen?

We have now noticed some of the considerations which appear to favour the supposition that the vital principle is a thing *sui generis*.

1st, the unparalleled hiatus which exists between things animate and things inanimate.

2nd, the great dissimilarity between the properties of the imponderables and those of vitality.

3rd, the difficulty arising from the hypothesis that the embryo of a living thing is developed only by agencies analogous with known forces.

4th, the permanence of form and structure observable during many generations of the same species.

5th, the absence of any indications as to what becomes of the vital principle at death.

6th, the periodicity of life.

It is not contended that these considerations amount to a demonstrative proof that the vital principle is a thing *sui* *generis*, but the question naturally arises, how far, supposing our conclusion to be a right one, a demonstrative proof is possible.

An instance somewhat parallel may be found in the field of Natural Theology, in which is assumed, as a starting-point, the existence of a first supreme Cause, whose nature is beyond all comprehension; certain facts are adduced which agree with this assumption; also its rejection is shown to involve many great difficulties; but all this is not proof; and in fact proof here seems to be out of the question, for the simple reason that whatever *that* might be of which the existence could be proved, it would not be the infinite one. In logic, as in mechanics, action and reaction are equal, and the very *locus standi* required by a proof, in the thing to be proved, puts demonstration in this case out of the question. Similarly, if the existence of vitality as a distinct thing were capable of being demonstrated by direct proof, the vital principle must be of the nature of other agencies, which is contrary to the original hypothesis.

It would be very interesting to trace the course of those discoveries in physiology which have led some eminent observers to class vitality with other known forces. It cannot be denied that a very large number of facts connected with the phenomena of life, formerly supposed to be attributable only to the undefined agency of the vital principle, are now accounted for on principles which are purely scientific. For example, the constituents of some of the proximate elements of organic substances, such as starch, albumen, &c., were known long ago; but the power to combine these constituents so as to produce the proximate elements was regarded as being possessed by the vital principle alone, the working of which in the formation of the proximate elements could, it was thought, by no means be imitated in the laboratory. This is now known to be an error; the chemist by his science does that which before was considered to be the peculiar function of the vital principle. In these and many other instances, it has been proved that the aid of the vital principle has been unnecessarily invoked to account for results explicable on scientific grounds.

In all this we have a parallel to that which has taken place in the more extensive field of the Cosmos. Yet there are some who are conscious that if it were possible to trace the existing state of things by a regular series of scientific deductions to a nebular condition of the universe, no appproach would be made thereby to the possibility of dispensing with a first supreme cause.

It is, however, abundantly evident that the great Originator of nature has chosen to accomplish his purpose by a wondrous succession of fixed laws, open to our investigation, and revealing depth beyond depth to a most remote and obscure profundity.

With this fact before us, on the hypothesis that the force of life, like its author, possesses an unknown, perhaps an unknowable nature, we should not expect its interposition to be conspicuous; we should, I think, expect its agency to be executed only behind a succession of fixed laws, forming a vista, having its termination almost lost in the distance. The natural evidence in the two cases must of necessity, as we have seen, be of the same character, not direct nor demonstrative, but implied and inferential.

Whatever weight may be due to the considerations here urged in favour of the speciality of the vital principle, at all events they answer these expectations and conditions. Those arguments on which most stress has been laid arise at points where, if evidence be possible, any one who thinks at all on the subject, would expect to find it. Something altogether unusual in nature marks the boundary of the province in which life-force prevails; and the phenomena of life do not submit to be accounted for under the rigid laws which govern the application of all forces that are known.

Since the greater part of the above was written I obtained the first number of the *Quarterly Journal of Science*, in which appears a paper by Dr. Carpenter, part first, " On the relations of Light and Heat to the Vital Forces of Plants." The views of so eminent an authority will everywhere command attention and respect, and it was not a little gratification to myself to find that on the whole they were consistent with those expressed in this paper.

By far the greater portion of Dr. Carpenter's paper is taken up with matters perfectly compatible with, but having no direct bearing upon the question we have had before us. In one short sentence, however, he thus states and illustrates his views on the point in question:—

"The history of a living organism then is one of incessant change, and the conditions of this change are to be found partly in the organism itself, and partly in the external agencies to which it is subjected. That condition which is inherent in the organism being derived hereditarily from its progenitors, may be conveniently termed its *germinal capacity:* its parallel in the inorganic world being that fundamental difference in properties which constitutes the distinction between one substance, whether elementary or compound, and another; in virtue of which each behaves in its own characteristic manner when subjected to new conditions."

That which I have spoken of as the vital principle, Dr. Carpenter here seems to denominate the " germinal capacity;" but without attempting a definition of the germinal capacity, he gives an illustration which amounts to this:—That the germinal capacity of one living thing, differs from that of another living thing as an atom of hydrogen differs from an atom of oxygen. We do not require an illustration to be perfect in all respects, and, on the whole, this one seems to me to answer its purpose. But if it be contended that the illustration goes much deeper than I have represented, then in reply, I must urge, with the highest respect for the author, that the sentence is not so lucid as I am sure Dr. Carpenter himself would wish it to be; that a capacity cannot be parallel to a fundamental, or any other difference; and that certainly it cannot be Dr. Carpenter's meaning to compare the germinal capacity of an organism with the atomic properties of an inorganic substance, when, according to his own showing, the former produces "*incessant changes;*" the latter, permanent combinations; the former is "*derived heriditarily from its progenitors;*" the latter can in no sense be said to have had progenitors; the former is the "*inherent condition,*" the latter the chief source of the influence of external agencies.

In fact nothing can be more satisfactory to myself than the distinction which Dr. Carpenter in another part of his paper draws between heat as the "constructive force" and the "germinal capacity," the vital principle of this paper, as the directive agency in the development of the living organism. He compares the germinal capacity to the control exercised by the superintendent builder who is charged with the working out the design of the architect! Heat he compares to the bodily force of the workmen who labour under his guidance in the construction of the fabric.

This is indeed saying all that I would wish to say much better than I could myself have expressed it. The only remaining question is, will other physiologists be content with this—content to leave far out of the reach of their correlative forces the vital principle, the "germinal capacity," the working of the "*superintendent builder charged with the execution of the design of the architect.*" I think not, and therefore, I venture to submit, the arguments of the preceding paper are not needless; for it may be remarked of the nature of the germinal capacity, that though he admits that it occupies the very first place in importance, Dr. Carpenter does not, I believe, say anything beyond what has been quoted.

In the commencement of his paper, Dr. Carpenter speaks disparagingly of a class of reasoners who uphold a "hypothetical vital principle, a shadowy agency that does everything *in its own way,* but refuses to be made the subject of scientific examination." There is an amusing similarity between the statement concerning the vital principle here ascribed to defective reasoners, and the statement which Dr. Carpenter makes respecting his own "germinal capacity," at the close of his paper. "The special attribute of the vegetable germ is its power of utilizing *after its own peculiar fashion* the heat which it receives, and of applying it as a constructive power to the building up of its fabric after its characteristic type."

An interesting discussion took place, and on the question as to the extinction of these gigantic birds, Mr. SHERBROOKE WALKER stated that "the Maories, in New Zealand, certainly have some traditions respecting it, but it is questionable if they can be relied on. They say that formerly the Moa birds were very numerous, and used to kill the native children, so that at last, fearing that if they did not destroy the race of moa birds that the Moas would exterminate theirs, they held a council and determined to burn the island, and, according to them, a day was fixed, and the whole of the east coast was set fire to at the same time, whereby the gigantic race of birds was entirely destroyed. Whether there is any truth in this report or not, it is impossible to say, but is is very evident that all the east side of the middle island was once heavily timbered, for go where you will, on hills or plains, you will find large burnt logs of a species of pine, called by the natives 'Totara,' which never decays in the ground; and also, but much rarer, burnt logs of a sort of cedar, now quite extinct on the island. These logs are charred on the outside, but as sound as the day they were burnt when you take the outside off None of the other sorts of wood which decay in the ground are ever found, thereby clearly showing that it must have been some time since the island was burnt, for all traces of other woods, too, have vanished. You will ask, possibly, how it happens that there is any timber at all left in the island. I can only account for that, by supposing them to have been protected by a swamp or river. We sometimes find the moa bones in swamps, which would lead one to think that they might have fled into them for protection from the fire. Many people believe to this day that they still exist in the unexplored forests on the west coast, and I, confess I am not altogether incredulous of their existence myself. I only know of one instance of a Maori saying that they had seen one personally, which was to a friend of mine, whom an old woman told that when she was a child she remembered having seen one, and described the place where she had seen it, which was an open tract of country towards the west coast. My friend, thinking that it sounded as if there was some open country there, went down on an exploring expedition, and found the place exactly as she described it, but no Moa bird. He ultimately took up the country for sheep farming purposes. The Maories have also traditions that these birds used to go into caves, and that their ancestors made large nets of the New Zealand flax (Phormium tenax) and, having caught them, used to eat them. Another friend of mine was told by the natives, when he was going up into the interior of the country, that he would be sure to see Moas, but that they would not hurt him; however, he never saw any. There had been several reports of Moas having been seen, but hitherto none of them have been confirmed."

Mr. MOORE exhibited a stuffed specimen of the New Zealand owl-parrot, *Strigops habroptilus,* (G. R. Gray), from the Derby Museum, the species referred to in the following note lately given to him by Mr. Walker, detailing a very singular habit:—"You asked me for some information respecting the 'Rakapo,' or large New Zealand ground parrot. It is found in great numbers on the west coast of the Middle Island, but very rarely any where else. It is about the size of a common fowl, with a varied black and green plumage. The only one I ever saw alive was brought from the west coast by Mr. J. C. Watts Russell, of Canterbury. It was evidently a night bird, as it always hid itself under some thick plant (being kept in a small patch of enclosed flower garden) in the day time. It cannot fly at all, and has a very singular way of progressing, giving a hop forward, and then putting its head down and resting its forehead on the ground. At first I thought this might arise from the specimen I saw having a broken leg; but Mr. Watts Russell, a gentleman of undoubted veracity, and who must have had plenty of opportunities of studying their habits (having lived upon them for some time whilst on the west coast), assures me that they never use any other mode of progression than that I have described, viz., using their head as third foot, as it were; much in the same way as we see the common parrots use their bill as a third foot in climbing. It is entirely a ground bird, and is singularly like an owl, on account of the feathers radiating away from the eyes, as in the owl tribe."

Mr. WALKER exhibited a number of animals collected from the Gulf-weed during his homeward voyage, consisting of specimens of Pipe-fish *(Syngnathus)*, Painted Hand fish, or Toad-fish *(Cheironectes)*, several Crustaceans and *Velellæ;* two small *Cephalopods;* two *Nudibranchs* and an *Acaleph,* which he presented to the museum.

EXPERIMENTS WITH ROTATING DISCS.

Mr. ALFRED HIGGINSON exhibited some Experiments with Rotating Discs, and made the following observations:—

Any body, even of irregular form, when made to rotate rapidly, will (if free to do so) arrange itself in such position as to spin round its shortest axis; that axis moreover passing through its centre of gravity;—and, if the rapid motion could be sustained, would show the various phenomena of gyration. The regular form of an oblate spheroid, or a disc with thickened margin, is however, the most convenient figure. Such a body when supported, and spinning, on its very centre of gravity, will not of itself change the direction of its axis, or its plane of rotation; but will resist any effort to change it by a force applied from without. This may be called the *balanced top,* the centre of gravity and centre of motion coinciding; and the top, when spinning or not spinning, will rest at any inclination at which it is placed.

When the centre of gravity is below that of motion or support, the top when at rest will always assume a perpendicular position of its axis. This may be called the *under*-balance top.

When the centre of gravity, however, is above that of support or motion, the top when not spinning will fall over, and may be called the *over*-balanced top.

Mr. HIGGINSON exhibited an instrument, invented by himself about the year 1829, capable (in its present more accurate form) of spinning for fifteen minutes, and in which these three different adjustments of centre of gravity and centre of motion can be made at will.

1. The *over*-balanced condition was shown to correspond to the familiar toys, peg-top, whip-top, humming-top and teetotum. When rotating with the axis inclined, it was shown that a gyration takes place in the *same* direction as the revolution of the disc, and the toys named move also in an *orbit* in the *same* direction when travelling on the floor or table.

2. The *under*-balanced adjustment corresponds to the real condition of the earth in its diurnal rotation on its axis; but the gyration is in each instance in a direction the *reverse* of its rotation; and is, in the case of our globe, the cause of the precession of the equinoxes.

3. The *balanced* state of Mr. H.'s instrument is identical with the condition of the Gyroscope, when well made and not subjected to extra weight and pressure from without; and the experimenter believed that many of its seemingly capricious movements were explicable on the principle of the sudden conversion of the disc of the Gyroscope from the *over*-balanced to the *under*-balanced top, or *vice-versâ,* with their distinct and opposite gyrations. These gyrations themselves are easily intelligible on physical principles relative to the action of two or more forces.

In the *balanced* top, when spinning in an oblique position, each particle at the equator will be carried from one node to the exact opposite, and there will be no alteration in the direction of the axis of rotation; while in the *over*-balanced, the node will be carried forward in the *same* direction as the spinning, and in the *under*-balanced the node will be thrown back in a direction the *reverse* of the spinning. In each case, the obliquity of the axis is not changed; but in the one it revolves at the same angle in the direction of, and in the other opposed to, the spinning of the top.

Spin the Gyroscope (with double gymbals,) and when the axis is vertical it will admit of being pushed round horizontally with perfect ease in the *same* direction as its rotation, but resists completely an impulse in the opposite direction, until the disc has turned itself upside down; the rotation is then in harmony with the impulse, and it will turn without difficulty; reverse the impulse, and it will not move round until the disc has reversed itself. Couple the two rings of the Gyroscope firmly together and it will then turn freely in either direction, without reversing its poles. When free to move, it was the *over*-balanced top, and it acted accordingly. Now place the axis horizontally, and with a thread attempt to raise one pole; gyration will ensue in a direction opposite to the rotation;—it is the *under*-balanced top, in all essential conditions. A weight hung at the other end of the axis produces the same effect as the thread in this experiment.

Mr. Higginson expressed the hope that any member of the Society, who might not be at once convinced of the validity of his statements, would yet feel sufficient interest to follow up this curious subject with investigations of his own.

The following paper was then read—

ON THE

DETONATING METEOR OF DECEMBER 5TH, 1863.

BY ALEXANDER S. HERSCHEL, ESQ.

(Communicated by F. J. Bailey, Esq.)

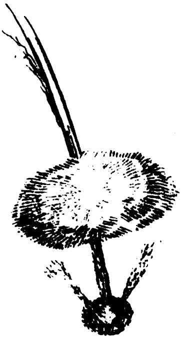
Meteors of the detonating class are rare and their occurrence deserves a more careful consideration than a cursory notice of their appearance in the columns of the daily newspapers can supply. Professor Heis, director of the Royal Prussian Observatory at Münster, set an excellent example to Meteorologists in the early part of last year, by the personal enquiries which he undertook and completed upon the track of the meteor of March 4th, 1863, in the southern part of Holland. This great meteor offered small difficulties to an astronomer of Professor Heis' experience, from the length and small inclination of the visible path by which it approached the earth. Many distant places contributed their observations, by which the beginning and end of the rectilinear flight could be determined with precision, and hence it was possible to infer that the luminous body was foreign to our solar system and came from the trackless region of the stars.

The occurrence which now demands our attention is that of a detonating meteor in England, on the 5th December last. Mr. R. S. Hart writes on the subject to "The Times," from Hawkshead, Windermere, as follows :—" The evening was calm and clear. From four to five minutes after the disappearance of the meteor a distant rumbling sound, which continued for two or three seconds, and resembled that arising from a railway train passing over a bridge, was distinctly heard by myself and others. It came from the south-west, the direction towards which the meteor seemed to fall. Although the circumstance has not been alluded to by any of your correspondents, there was no doubt entertained by those who heard the sound, that it was occasioned by the meteor." It is sufficient to awaken our interest in this astronomical occurrence to be assured that a body so near the confines of empty space as to light the whole of England with a flash like lightning should be perceptible to our restricted and material sense of hearing. What then were our more ethereal organs of perception able to witness of the event ?

We may recall the appearance which the meteor presented at Liverpool, at Oldham (Manchester), at Burton-upon-Trent, at Preston and other places.

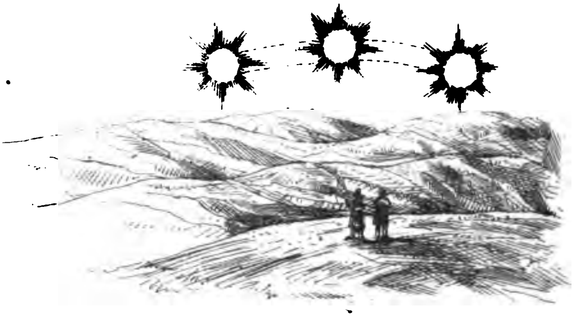
Mr. W. G. Drysdale writes—" It at first assumed the form of a falling star, and such I took it to be, until after descending several degrees, it suddenly burst forth into a large blue light, so brilliant as to cast shadows from objects on the earth. As this light was fading, a drop or pendant, of a dull red colour ran down from it and terminated in a small explosion. The diagram represents the image left on my mind after the disappearance of the whole." (Fig. 1.)

Mr. W. Bentley writes from Oldham—" At the time of its maximum brilliancy it was as light as the finest moonlight night. At the commencement it was as a ball of fire of one-third the apparent diameter of the moon, and of a lemon-shape and brightest at the lowest point. It proceeded some distance, leaving in its track a band of fire of a bluish white colour, when a very bright jet of fire was projected from the lowest part of the ball some distance. The whole of the ball was instantly a mass of fire, of the most brilliant kind, surrounded especially on the upper side with a vivid blue flame, and became suddenly extinguished, leaving a band of red flame which appeared to be cut in two at the point where the ball was."



APPEARANCE AT LIVERPOOL.

FIG 1.



APPEARANCE AT HASTINGS.

FIG 2.

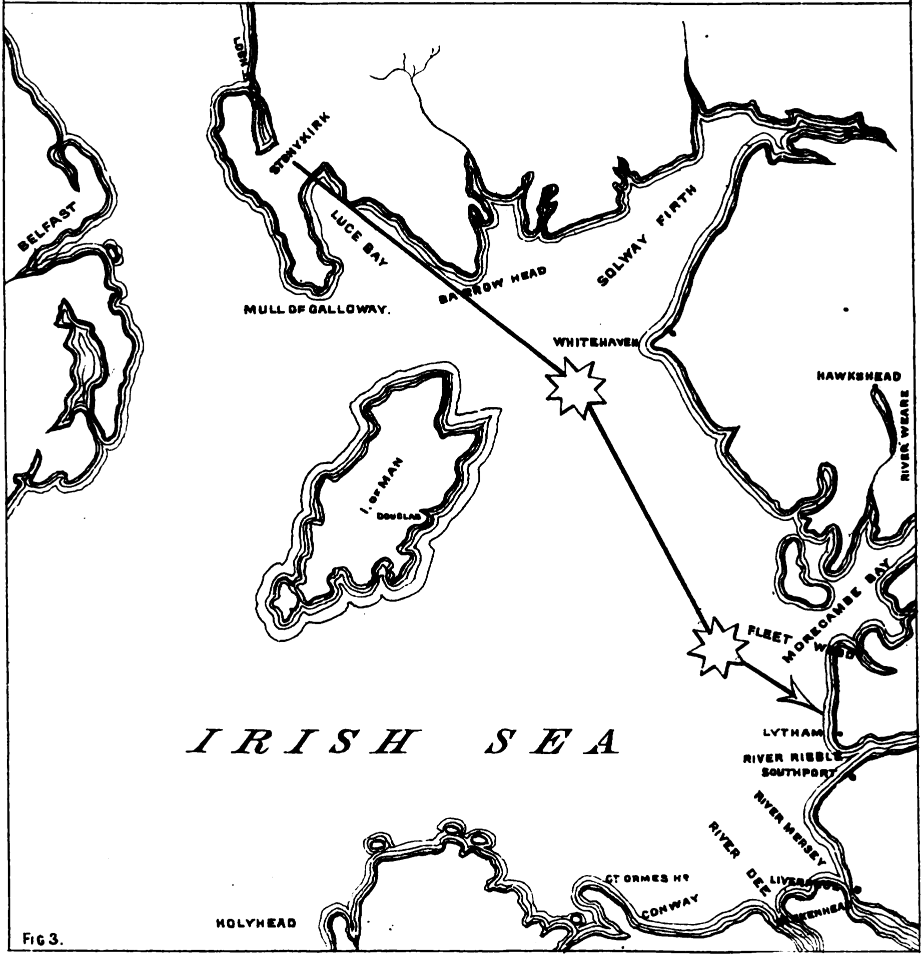


FIG 3.

PATH OF THE METEOR.

The following is the description at Burton-on-Trent—" On looking up, I perceived a globe, at least four times as large as Jupiter appears to the naked eye, of a pale blue colour, and of an intense light. It fell vertically through an arch of about fifteen degrees, and vanished, emitting during its passage four or five balls of crimson red light. The pale blue light of the meteor was most brilliant, and, contrasted with the red balls emitted from it, produced one of the most gorgeous sights it has ever been my fortune to witness."

At Blyth (Northumberland), Mr. M. W. Bullen describes the flakes of crimson red light as " pear-shaped drops left behind, as if from a molten body."

At Preston the meteor appeared " as a ball of fire about half the size of the moon, followed by a brilliantly red and fiery train of a more permanent and fixed appearance than usual. The nucleus emitted a blue purple light of a flickering and glaring character, as if the ascensional tendency of flame were impeding its descent towards the earth."

At Selkirk the meteor was described as "round and large, looking like the moon descending with a waving motion behind a bank of clouds."

At Parkhill, near Inverness, it "vanished in a vertical direction amid a shower of apparently falling fragments, which at the same instant assumed a deep red colour."

At Howden, near Hull, it was " a nucleus of brilliant light descending quite vertically in a momentary transit to the earth. When in appearance it touched the earth it exploded like a shell from a mortar. The fragments were of a most brilliant red, but no tinge of blue was observed."

The explosion appeared to Mr. R. Sutcliffe, at Idle, near Bradford, like the discharge of a rocket, burst before him at the distance of a few hundred yards, altogether unlike an ordinary meteor or falling star. The lights seemed purple and blue and white.

At Ledbury it "gradually descended in a perpendicular direction, emitting bright sparks as it fell."

At Stretford, near Manchester, the two flashes of the meteor (the second brighter than the first) drew the attention of the observer, who turned about in time to see them falling,—"purple and yellow balls of light which illuminated the country for a few seconds, and disappeared."

The two flashes were seen at Liverpool by Mr. F. J. Bailey, in a place where high buildings obstructed the view of the meteor, "immediately succeeding each other, of a blue tint, similar to the blue-light in colour, and lasting some five or six seconds, passing from the N.W. to the N.E., not far from the situation of the polar star."

Mr. A. Brothers writes from his observatory in Manchester—"While observing α Andromedæ about 30 minutes past the meridian, through a telescope of 5½ inches aperture, with a power of 30, I distinctly saw two explosions as the meteor seemed to cross the field of the telescope. The light was more brilliant on the west than on the east side, but the effect was so instantaneous that it is not easy to say what was really seen. Of these facts I am certain—the meteor burst *twice*, and the colour of the light was blue."

An observer at Little Horton, Bradford, "walking in the open air, was startled by the sudden light. On looking up, the meteor remained in sight three seconds, and disappeared in a coruscation of light formed of the brightest hues."

Mr. W. E. Buck, of Hastings, avers that the meteor was of the same brightness from first to last, but shot or exploded three different times, "that is to say, when first observed, and twice afterwards (see fig. 2). At each of these explosions the brilliant nucleus appears to have been enveloped in red flakes and debris of the shock," for an observer at Chesterfield writes—"The meteor appeared first as a large white ball, then it changed to red, then white or green, and before it was extinguished red again." He adds, "I saw the meteor of the 8th December, 1861, and it was quite similar to this one. The meteor of that date suffered two dismemberments of its body into red masses, and expansions of its light, the first at fifty miles over Lancaster, where a powerful report succeeded, the second at forty miles above the Irish sea, where the meteor disappeared." A writer at Hale, near Manchester, does not particularize any changes of form after the illumination attracted his attention to the object—"The nucleus was white and its train purplish red. It emitted sparks like those from a blacksmith's anvil."

At Kingstown, County Dublin, Ireland, "a ball of blue flame with a long feathery tail of fire, extending behind and upwards, lit up the eastern sky for several seconds like a broad flash of sheet-lightning. It finally emitted some brilliant sparks and descended into the sea."

At Douglas, Isle of Man, "the shape was that of a broad-headed spear, the blade of which, of pale green flame, was equal to the apparent diameter of the moon in length, and about half that extent in apparent breadth. The part next to it, say the shaft, was of a deep red, continued in a chain of flame of the colour of ordinary gas-light. The whole appearance occupied about the time which would be taken by a common rocket to exhaust itself." No explosion was heard, and no mention is here made of changes of form or brilliancy of the meteor.

According to the account of Mr. W. G. Drysdale, at Liverpool, before mentioned, "the meteor at first assumed the form of a large bright star and fell rapidly some distance through the atmosphere. Its motion was then suddenly arrested, and it burst forth into a dazzling pale blue light, so large and intense as to cast a strong shadow from objects on the earth. From this magnificent centre a pendant ran down, terminating in a ball of lurid red, like an ear-ring of fire. "The meteor appears, therefore, to have been diverted from its original course as a falling star, at the moment of its brilliant expansion into a ball of pale blue light, and from this instant to have directed its course directly upon Liverpool, until at the final explosion and fading of the blue light, the lurid portions of the meteor again assumed a course parallel to their original direction. An observer in the open country, about eight miles from Manchester, informed Mr. Brothers that "at first the meteor appeared stationary, and his first thought was 'that's a strange place for Venus to be in,' when the meteor immediately darted downwards diagonally." This observer could, unfortunately, not give particulars of the position in which the meteor at first appeared stationary as a large bright star, but we are able to infer from this observation that before the meteor turned towards Liverpool as a fire-ball, it was directed in the form of a shooting star towards Manchester, and that at last, on the second shock, it followed in its expiring condition the same direction which it had originally at the outset.

The two changes of course were attended by distinct flashes of light, between which no great alteration of figure occurred in the meteor, but one coruscation, brighter than the rest, may, perhaps, be traced to have intervened. Those whose attention was attracted by the first flash noticed no change of direction. The alteration of course of the fragments at the final explosion was, however, observed in one instance at least (at Parkhill, Ross-shire), and ascribed to the effect of gravity on the liberated parts.

As a fireball, it had not a great length of run. Its angular extent at Hereford was only 2°; at Liverpool it was foreshortened to a point; at Douglas and at Preston it appears to have measured from 15° to 20°; at Manchester and at Burton-upon-Trent from 12° to 15°. The thick rain and dense clouds which hid the sky appear to have caused a perfectly erroneous impression of the meteor as observed at Hastings. The explosion at Haslingden, near Blackburn, in Lancashire, took place at at 4 degrees under α Lyræ.

The meteor appears therefore to have originated as a shooting star at 90 miles above Stonykirk, at the head of Luce Bay, Wigton, in Scotland, and to have thus advanced to 60 miles above the Irish sea, 40 miles due west from Hawkshead, Windermere, where it altered its course and expanded in light with a loud explosion, audible at Hawkshead, like the roar of a railway train. From this point the meteor moved as a fireball of the largest size towards Liverpool to a place 30 miles above the sea, and 17 miles West of Fleetwood, where it again underwent an explosion, with alteration of its course, and great expansion of its light terminating its display. The fragments moved from this point towards Manchester, and disappeared at a height of 20 miles above the neighbourhood of Lytham, on the coast of Lancashire. (See map, fig. 3.)

The distance from the point of first explosion to Hawkshead, Windermere, is 72 miles, and this interval is recounted by Mr. R. S. Hart to have been travelled by the sound in the lapse of from "four to five minutes." The velocity of the meteoric sound was, therefore, somewhat greater than a mile in four seconds of time, or than that ordinarily received as the velocity of sound in a horizontal plane of air.

At this meeting a paper was also read—

ON THE
LEPIDOPTERA OF THE HUNDRED OF WIRRAL, WITH A LIST OF THE SPECIES.

By J. FITZHERBERT BROCKHOLES, Esq.

[This paper and list will be found in an Appendix at the end of the volume.]

NINTH ORDINARY MEETING.

Royal Institution, 22nd February, 1864.

Rev. C. D. GINSBURG, LL.D., V.P., in the Chair.

Ladies had been invited to this meeting, and there was a large attendance.

Mr. Moore exhibited the following recent additions to the Free Public Museum:—A splendid pair of reindeer (*Tarandus rangifer*), obtained expressly from Lapland by S. R. Graves, Esq., by whom they were presented to the Museum. A very large calamary or squid presented by Capt. Graham, screw-steamer Nova Scotian; in lat. 47°51′ N., and lon. 38° 16′ W. that vessel, while running before a strong gale from the westward, Feb. 13, on her voyage from Montreal to Liverpool, shipped a heavy sea, when it was supposed to have been washed on board, as it was found on the forecastle about two hours after at daybreak. The specimen, the species of which is at present undetermined, belongs to the family of cephalopods, of which the *Loligo vulgaris* of the British seas is an example. It is, however, very much larger, the body being 26 inches in length, the eight ordinary arms surrounding the mouth varying from 13 to 15 inches, and the two extensile arms, measuring 40 inches, so that when these are stretched out, the total length of the creature is six feet. It lived for some hours after it was discovered, and was then kept in ice for six days. It arrived in perfect condition, and is a very interesting addition to the series of these creatures contained in the Museum. Also a globe of living fish taken from the Nile at Hagar, where the river is crossed by the railway, by Mr. Hardcastle, C.E., in charge of the line, who gave them to Captain Browne, of the screw-steamer Agia Sofia, who kindly presented them to the Museum. They are a species of carp, closely allied to the gold carp.

Captain **Browne** exhibited a pair of slippers, taken from an Egyptian mummy, and elaborately ornamented in gold, and having an inscription upon them also in gold. This inscription the Chairman stated to be in Coptic.

The Rev. H. H. **Higgins** exhibited a large specimen of *Chiton,* lately purchased for the Museum. It was obtained at Vancouver's Island, and appeared to be undescribed.

Dr. **Collingwood** explained a very beautiful diagram, made at the Liverpool Observatory by Mr. Hartnup, exhibiting the indications made by the anemometer, barometer, thermometer, &c., in the great gale of December 5.

A paper was then read, entitled—

THE GOOD OLD TIMES.

By Rev. JOHN ROBBERDS, B.A.

TENTH ORDINARY MEETING.

Royal Institution, 7th March, 1864.

J. BIRKBECK NEVINS, M.D., V.P., in the Chair.

M. F. Archer, jun., B.A. Cantab., and Thos. Skinner, M.D., Edin., were duly elected ordinary members.

The **President** drew attention to the recent death of Sir William Brown, Bart., one of the honorary members of the Society, and a resolution was passed expressive of sympathy with his family. It was suggested that members of the society who could make it convenient to do so should attend the funeral as representatives of the society.

Mr. **George S. Wood** made a short communication on the subject of the gyroscope, illustrated by experiments.

The following paper was then read—

THE ARITHMETIC OF BUILDING SOCIETIES.

BY J. M'FARLANE GRAY, ESQ.

BUILDING SOCIETIES generally have for their object to enable working men to become the owners of house property, which is purchased with money borrowed from the Society, and repaid by small periodical instalments, which include interest at about 7 per cent. per annum. By receiving this high rate of interest these societies are enabled to give a proportionately high rate of interest on the money entrusted to them, and become an eligible investment for those small sums which form the savings of the working classes.

In Liverpool, as far as I can learn, there are three classes of Building Societies—the Terminating, the Accumulating Permanent, and the Dividend Permanent.

A Terminating Society begins at a certain date and has a time fixed for its ending. In general its object is to yield to every investor of 10s. per month the sum of £120 at the termination of the Society. To enable them to accomplish this object, the subscriptions of the members are lent out among themselves at such a rate of interest as will increase the subscriptions to the promised amount in the given time. This description of Building Society is fast disappearing, and almost all new Societies are formed on the permanent principle.

An Accumulating Permanent Society is much the same as a Terminating Society, but its operations are continuous. A member can join it at any time without paying up any arrears, and when his subscriptions have continued for a specified number of years he receives the full amount of his accumulated share, with whatever bonus may have been declared upon it, and he withdraws from the Society, but the Society itself is permanent.

This form of Building Society was first proposed by Mr. Scratchley in his large work on provident associations. The erroneous principles in the working of the terminating Societies were therein fully discussed, and the superiority of this new class of Society pointed out. It must have been highly gratifying to that author to find that, all over the kingdom, steps were taken to wind up Terminating Societies and to form others on the permanent principle, as he had recommended.

The success of all such associations is entirely due to the operation of compound interest. In both of these descriptions of Building Societies the principal feature was the accumulation of the profits from year to year, and thereby the realisation of compound interest. It is to Liverpool that the credit is due of having discovered how to realise equal advantages to the investor without this accumulation; the British Building Society in this town was the first to put this plan into practice, and to divide its profits annually; and now there are in Liverpool fifty or sixty permanent Societies on this plan, all giving yearly or half-yearly dividends. I will restrict this paper to the arithmetic of these new Societies, —the Dividend Permanent Building Societies. The construction of the others has been already fully discussed by Mr. Scratchley in the work referred to; but this new class, which we find so common in Liverpool, as far as I can discover, is not treated analytically in any work. The stock of these Societies consists of an unlimited number of shares, which are generally £10 each, with an entrance-fee of one shilling per share. The entrance-fee is sometimes increased as the Society progresses, and is in proportion to the amount of reserve fund in its possession. These shares are lent out to borrowers, who pay a certain premium for the advance, and return the principal, with interest, calculated generally at five per cent., by monthly instalments, which amount in each year to the sum which would have been payable at the end of that year had the payments been made annually. By this arrangement the Society receives the use of all the repayments for, on an average, 5½ months, and the interest received by re-lending these payments during these months is added to the profits of the Society. If you ask a member of such a Building Society for an explanation of their operations, as you cannot understand how money lent at 5 per cent., with the premiums charged, can ever realise 7 per cent. upon the capital of the Society, you will be told that you underestimate the value of monthly payments, and that it is not only on the 5½ months' interest that they rely, but upon the fact that the same money can be lent and re-lent to different parties in the course of the year, and all of them pay interest on the same money at the same time, while the society has the use of this money actually for nothing, as they are all this time payments made in advance.

This is a very plausible explanation; but there is an amount of confusion in it, and I will now take the liberty of developing this principle in a practical illustration. Suppose, then that you take a £10 share in one of these Societies—say on the December meeting night, and we will suppose that the financial year of the Society terminates in December. If you pay your share in full you will be entitled next December to receive a dividend of perhaps 7 per cent upon the £10 now invested. But immediately you pay your £10 it is laid out as part of a loan of £1500. In January the borrower returns your £10 as his first monthly instalment, but he continues to pay interest upon it until the end of the year. The £10 returned in January is in like manner given out as part of a loan of £1500 to a second borrower, who returns it as his first instalment in February, and he continues to pay interest upon it also, for 11 months after he has returned it. It is again and again given out and returned, until, at the end of the year, it will be found that twelve borrowers are all paying at the same time 5 ℘ cent. per annum for the same £10. Of these, one will have paid for one month, one for two months, and so on up to the party who had it first, who has paid interest on it for 12 months. The addition of this is that there has been interest paid on the £10 for 78 months, or 6½ years, at 5 per cent. per annum, or 32½ per cent. This extraordinary increase is of course realised upon only a part of the money, and upon that only while it is a payment in advance. But as all the money pays 5 per cent. in addition to the premium, this 32½ per cent. upon advance payments, when divided over the whole capital, raises the realised profit to something like 14 per cent. per annum; and after setting aside a reserve fund and paying all expenses, they can afford to pay 7 per cent. per annum on the invested shares.

This explanation may appear to all present to be extremely absurd; and so it is—downright nonsense; but, gentlemen, there is not amongst the members of Building Societies one man in ten who could point out its fallacy. As in the question about the boots, when some one was about arriving at the proper answer, a hint that he had forgotten the boots was sure to set him all wrong again, so here there is always something to set us wrong; and, after all argument, the prominent fact that a Society has for 12 or 14 years continued to pay 7 per cent. per annum, and its accounts have never been challenged, appears to the investor to be a sufficient guarantee that it will always do so.

The operations of Building Societies are business transactions, and while some of them may be managed with a little sleight of hand, yet as sensible men we must repudiate the existence of all magic, and examine their pretensions upon the principle that profits can never exceed gains. The repayments of Building Societies are made monthly, and are of the same total amount as if they had been paid in one sum at the end of the year of the mortgage. If we suppose those repayments to be always re-let at the instant they are received, their total value would amount at the end of the year, with compound monthly interest at 7 per cent. per annum, to 1.0332 times the sum of the payments; at 5 per cent. they would amount to 1.02492. It appears then, at 7 per cent., the advantage of monthly payment is 7¾d. per pound on the total payments for the year; and at 5 per cent. the advantage does not amount to 6d. per pound; as the repayments in any one year never exceed 12 per cent. of the whole capital of the Society, it follows, the total advantage which can possibly be derived from monthly payments is an addition of 4-10th per cent. to the annual dividend. But this result can never be attained, as the money must be idle for a great part of that time. This statement is not to be modified by any consideration of its being in several hands at the same time, for it is based upon this circumstance, and unless a borrower be found to take up every fraction of the payments as they come in, this 7¾d. could not be realised. But the statement that the same money is returned over and over again in the course of a year is a false one. The £10 in the illustration given above was not returned on the next meeting night; it formed the 150th part of that loan, and only the 1-150th part of your share was returned on that evening. On the following evening, another part, equal to 1-150th, was returned by the first borrower, and the second borrower, on the same evening, returned 1-22500th part of your money. If you have a taste for such calculations you can follow this out for a year, and you will find that at 7 per cent., compound monthly interest, you will never make 8d. out of it. I will now go on to examine the nature of the loans, and the scales by which they are to be repaid.

The scale which is almost universally adopted by borrowers is the 20-year scale, by which £100 is repaid by monthly instalments, amounting to £8 per annum for 19 years, and to £8 18s. 6d. in the 20th year. In many Societies the premium on this scale is only £6 per cent.; that is, the Society pays £94 for certain payments which are to extend over a period of 20 years. It is a loan, not of £100 at 5 per cent., as the scale would indicate, but of £94 at £6.1317 per cent., or £6 2s. 7½d. per cent. per annum. I think I hear some one saying "But it is paid monthly." Let me assure you that unless it was paid monthly, and unless it was also re-let on the evening the payment was made, it would not realise even 6 per cent. per annum. I have calculated the present value of the 5 per cent scales, and have affixed them to this paper with their values at different rates of interest. Those scales in which the total annual payments are equal are valued as annuties. $V = \frac{1}{R}\left(1 - \frac{1}{(1+R)^n}\right)$ where V is the present value of £1 per annum, R the rate of interest to be realised, being R=.05 for 5 per cent., n is the number of years. This formula gives the present value—supposing the payments to be made annually; for monthly payments $\frac{1}{30}$ is added when the rate of interest is 7 per cent. per annum; and $\frac{1}{40}$ when the rate is 5 per cent., and intermediate values for intermediate rates.

For those scales in which the amount of *principal* paid annually is a constant quantity I have constructed the following formula :—

$$V = \frac{1}{R}\left(n\,r + \frac{R-r}{R} - \frac{R-r}{R\,(1+R)^n}\right)$$

Where r is to be taken as the rate of interest, on which the scale is constructed, and R is the rate which is to be realised by the loan. This is corrected for monthly interest in the same manner as the other.

If Societies are to pay, they must receive a higher rate of interest than they give to the members. I question if this has ever been the case in Societies lending on the 5 per cent. scales. Almost all the loans are on these scales, and perhaps 90 per cent. of them are on the 20-year scale. Now, as the Societies, as a rule, have been paying 7 per cent. per annum to shareholders, and as in no single instance have they ever received such a premium as would yield them 7 per cent. even under mathematical conditions, and in general have never received more than 6½ per cent., it follows that many of these Societies are at this moment insolvent; that is, they cannot pay their members 20s. in the pound by selling every mortgage in their possession at their market value, or even at their cost price. The present value of the 20-year scale to yield 7 per cent. per annum is £87 16s. 4d.,—that is, the premium ought to be £12 3s. 8d.; but instead of this it ranges from £6 to £10.

I have as yet said nothing of entrance-fees and fines. Entrance-fees of themselves ought not to form a part of the profits of a Society; they ought to remain intact as a reserve fund. They would form, it is true, but a very small reserve fund; but better small than none at all. There is at present no reserve fund in any permanent dividend Building Society lending on the 5 per cent. scales. A little consideration will show clearly that this is the only equitable allotment for entrance fees. The interest of this fund should form a part of the annual dividend, and the member who remains in the Society reaps the full advantage of his entrance-money. In many of the Societies the entrance-fee has been raised from 1s. to as high as 7s. 6d. per share. There has never been any just ground for this increase—the legitimate source of profit is the borrower, and not the lender. No Building Society has ever been nearer solvency than when it started; and if members then bought a £10 share in the concern for

£10 1s., there is no just reason why members joining at a time when the shares have depreciated should pay a premium for doing so.

Fines and transfer fees form justly a part of the annual profits. These are supposed to be sources of great profit, but when they are set off against the working expenses, bank commission, and property tax, the balance is generally on the wrong side of the ledger.

If we examine the statement of present values attached to the scales, we find that wherever 7 per cent. per annum is realised on a 5 per cent. scale, the premium is about one-fifth of the total 5 per cent. interest in the column of interest. In one scale this is not the case, but it is not correctly a 5 per cent. scale. It thus appears that the total interest paid by the borrowers is about one-fifth more than what appears in the books as his interest. From this relation we arrive at a very convenient *approximation*, for the use of members of committee, in settling the amount of dividend to be declared. If the loans in any society have all been let to realise under mathematical conditions 7 per cent. per annum, and if the repayments are on a 5 per cent. scale, then the income of the Society from such loans is one-fifth more than the sum entered in the books as interest, and the amount of premium need not appear in the calculation of income. In every case the addition ought to be just that part of the total interest that the premium is of the sum of the interest column in the scale of repayment, added to the proportion of the whole payments allowed for the interest on the monthly instalments, viz., $\frac{1}{40}$ for 5 per cent. But you will again remind me that the repayments are made monthly, and re-lent, &c., and that I lose all that by this rule. Not at all. Add the premium to the interest column, and you do not get 7 per cent. by annual payments; it is only by monthly payments that the 7 per cent. is gained. But in adding one-fifth to the total interest received for the year, we get a hold of all the monthly interest and profits too, and increase them likewise by one-fifth.

The basis of my reasoning is this:—I look at the amount of premium only to arrive at what is actually lent; for, whatever the rules may say to the contrary, premiums are only *nominal* amounts, and when a transaction at 9 per cent. premium is recorded, it would be equally true, far more correct, and less likely to mislead, to state that £91 only had been lent at 6½ per cent. per annum interest. It is evident that over the whole period of the loan this approximation will adjust itself to be in the long run quite correct. But it is also necessary that in the individual years it should apportion to the then members their fair share of the profits.

I will now take a numerical example, and demonstrate to you that at the outset the members will receive a little more than their fair share by this mode of striking a dividend, and, therefore, that the income derived from loans is never more than is indicated by this approximation.

When £100 is lent on the 5 per cent. scale to yield 7 per cent. per annum, the premium is £12 3s. 8¼d., and the sum actually lent is £87 16s. 3¾d.; and what we have now to arrive at is, does one fifth added to the interest received for this £87·8 equal 7 per cent. per annum upon it? Now 7 per cent. upon £87·8 is £6·146. This is the amount to which the approximation should bring the booked interest. The amount of the first year's instalments is £8, but this is increased by monthly compound interest to £8·23; deduct £3 principal, the remainder is £5·23; one fifth of this is £1·046, and this added to £5·23 gives £6·276, so that at the outset at least the members would have no cause to complain, and in the long run the new mortgages would enter along with the old ones, and equalize the differences.

I will now strike the dividend in a few of the reports which are on the table before me. They are numbered, and I take them at random:—

No. 1.—" *The Albion.*" *Sixth Report.*

INCOME	Interest				£1679	2	8
	Add one-eighth. This supposes a premium of £7 10s. on the 20-year scale				209	17	10
	Fines				64	11	10
	Transfers				11	16	9
	Bank Interest				102	8	3
					£2067	17	4
EXPENDITURE	Expenses	£119	12	0			
	Property Tax	56	0	0			
					175	12	0
	Available for dividend				1892	5	4
	× Rate per cent. of dividend paid				7		
	÷ Dividends actually paid	£2526	19	5)	13245	17	4
	= Rate per cent. of dividend realized				5	4	10½

But instead of adding one-eighth of the total interest, we should add one-eighth of the interest received on this year's *new* mortgages only, as the premiums of all older mortgages have already disappeared from the funds of the society. When this correction is made the realised rate of dividend becomes £4 16s. 2d.

But instead of declaring a dividend at the rate of 4¾ per cent., as they ought to have done, the report informs us that, " after paying a dividend at the rate of 7 per cent. per annum, a considerable balance will be carried to next year's account." .

No. 2.—" *The Monarch.*"* *Fifth Report.*

INCOME	Interest				£1072	5	11
	Add one-eighth (as above)				134	0	9
	Fines				14	18	9
	Transfer				2	4	0
	Bank Interest				37	9	9
					1260	19	2
Expenses					131	1	11
	Available for dividend				1129	17	3
	× Rate per cent of dividend paid				7		
	÷ Dividends actually paid	£1590	17	11)	7909	0	9
	= Rate per cent. of dividend realized				4	19	5
	Corrected for deficiency of reserve balance as in No. 1				4	13	3

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* Of these two societies David Lewis, Esq., of the Bank of England is president; and, while correcting the proof sheets of this paper, I observe in

This report shows under 4¾ per cent. realized, and 7 per cent. paid.

No 3.—“ *The Rock.*” *Sixth Report.*

INCOME	Interest	£1104	14	2
	Add one seventh (I have no information as to the amount of premium), this allows £8 10s. premium on the 20-year scale	157	16	2
	Fines	6	3	0
	Transfers	8	7	0
		1277	0	4
Expenses		247	13	1
	Available for dividend	1029	7	3
×	Rate per cent. of dividend paid			7
÷	Dividends actually paid £1363 6s. 2d.)	7205	10	9
=	Rate per cent. of Dividend realised	5	5	9
	Corrected for deficiency of reserve balance	4	19	9

This report also declares a 7 per cent. dividend. I might go on for hours getting similar results. These extraordinary dividends are ruining the Societies, but perhaps you cannot see how. The balance-sheet shows that everything is right, apparently, but the balances due by the borrowers are not payable at the present date, and they are not worth the sums set down for each. The shares of the members no longer exist intact in the funds of the Society; they have been reduced by these imprudent dividends, and are now minus their amount, increased by compound interest, since the date at which they were declared. They do not appear as deficiencies, because the mode of book-keeping in these Societies is a perfect blind as to the true state of the funds. Having studied this subject, I would suggest to all members of Building Societies that they have their stock valued by an actuary, to know exactly how they stand; and after that they ought to enforce that in the Society's ledger only that sum which is actually lent should appear, with interest at the rate of 7 per

to-day's *Mercury* (July 20), that these and other societies have just presented that gentleman with a "very handsome testimonial" in appreciation of his valuable services as president.

cent. per annum. A standard minimum of premium to realise 7 per cent. should be adopted for each scale, and when a higher premium is received it should be divided with next year's profits. While the Society's books are kept in this way, the pass-book of the borrower should be kept as at present, and the two results will always agree. By this method the members would always know how the Society stood, and would not have the excuse of blind ignorance, as at present, for cutting into their capital. The rate to be realized might be fixed at less than 7 per cent., but it should never be less than the rate per cent. taken to pay the expenses and dividends.

Before concluding I must again tell you that I have been only treating of 5 per cent. scales. There are several Societies now working on 6, 6¼, or even 6½ per cent. scales, and of course, with these, there is less chance of deterioration, for they actually realise 7 per cent. per annum. There is one set of reports on the table with high rate scales. By one of these tables £100 is lent at 6 per cent. premium, and repaid by monthly payments, amounting to £8 per annum for 25 years, the interest being calculated at 6¼ per cent. In the 5 per cent scales the same premium is charged, and the sum is repaid in 20 years also at £8 a-year.

APPENDIX.

When this paper was read before the Society, the Appendix consisted of tables of values of 5 per cent. scales calculated by logarithms; and an analytical investigation of a hypothetical Society realising 7 per cent. dividends. At the request of some Building Society people, I have gone into these details again, using only the rules of common arithmetic, and I find that for any Building Society problem, these rules, properly applied, are all that is wanted. I have in this appendix gone into several of these problems very minutely, and my object being to make these things better understood than they generally are, I have aimed at plainness in all my statements, and I hope no reader will be disappointed in this respect.

Five per cent. scales are those treated of in my paper, and I will still confine myself to five per cent. scales, as they are those almost universally adopted in Liverpool.

The repayment scales all profess to be correctly calculated, but I find that several of them are a little in error. The 20-year scale has 19 times £8, and in the last year it ought to have £8 16s. and three-eighths of a penny, but this varies from £8 18s. in some societies to £9 4s. in some others. It is necessary that I should notice this, as the result of my calculations, although correct for the scale I give, will not be strictly accurate for the scales which differ from it.

I wish my statements to be tested in every possible way, but in doing so, please to notice that there are also misprints in some of the Societies' tables of scales, as, for instance, in the table which gives £9 4s. as the twentieth payment; the amount remaining unpaid at the end of the 7th year is stated to be £73 15s.; this ought to be £75 11s. 6d.

The most important problem in Building Society arithmetic is the valuation of the outstanding mortgages. This can be done very simply, and to any degree of accuracy, by dividing and adding. The present value of any future payments depends upon the rate of interest in the money market. If you can get 5 per cent. for money, then the present value of a sum of £105 to be paid to you in one year is exactly £100. This is very plain when these are the amounts; but suppose now the future payment to be £296, payable in one year, the present value would be found, by dividing £296 by 1·05, to be £281·905. This is the principle on which present values are calculated. When the rate of interest is 5 per cent. £1 becomes £1·05 in one year, and therefore, we divide the payment then due by this 1·05 to find how many pounds are the present value of it. In like manner, when the rate of interest is 6 per cent. we divide by 1·06, when 7 per cent. we divide by 1.07, and when 6½ per cent. we must, of course, divide by 1·065. When the sum is to be paid in two years we divide twice by this divisor: that is, we first divide the sum by 1·07, if for 7 per cent., and then we divide that quotient also by 1·07; and this division must be made just as many times as there are years to elapse before the payment falls due.

When there is a number of future payments falling due at different periods, we must begin with the last payment first, find what will be its value when the payment preceding it is due, and add that value to this payment; then find the value of this sum when the next preceding payment is due, and add, and so on, until the present value of all the payments is found.

By a simple device we can very much reduce the labour of this calculation. As the rate of interest is the same through it all, the same divisor will be used throughout. On a slip of paper write the products of this divisor by each of the nine digits as under—

1·07	2·14	3.21	4·28	5·35	6·42	7·49	8·56	9·63
1	2	3	4	5	6	7	8	9

Let the products be at the upper edge of the strip. In calculating present values this strip is placed by the left hand with the products under the dividends, or under the remainders, leaving a space between on which to write the new remainder, and in this way all the multiplication is saved, and the operation is reduced to one of addition and subtraction only, and the risk of error is lessened.

In illustration of this method I have introduced an example in Table I. It is the calculation of the 20-year 5 per cent. scale. The annual payments are £3 until the last year, when the payment is £8·80161 or £8 16s. and a fraction of a penny. The value is taken at 7 per cent. per annum, and the strip used is that given above. The figures running diagonally are the remainders found in performing the divisions, and are reproduced here to show exactly what is meant.

The last year's payments amount to £8·80161 ; this is written down as shown, and the quotient found by dividing it by 1.07 is written in the following column, but one line higher. The other payments being exactly £8 the addition can be performed without writing the £8 ; this is done, £8 added to 8·2258 gives 16,2258 which is also divided by 1·07. The quotient now reached is 15·1643, which is evidently the correct value of the payments of the 19th and 20th years, if purchased at the beginning of the 19th year, or what is the same thing at the end of the 18th year, if the rate of interest be 7 per cent., supposing the payments to be annual payments, but as the sums are paid up by monthly instalments they are of greater value. If the monthly payments could all be let at 7 per cent. on the same night on which they were paid in, then we should allow 7 per cent. compound interest upon them, and this would amount to one-thirtieth of their sum. I have done so in the 7 per cent. calculations given in my paper, but in practice these odd payments do not realise on an average even 5 per cent. One pound paid by monthly instalments, 1s. 8d. per month, will increase by lending the instalments, at 5 per cent. compound monthly interest, to 20s. 6d. at the end of the year. This is one-fortieth more than the pound itself. At simple interest, it would have amounted to 20s. 5½d., but as one-fortieth is more easily reckoned, I will adopt it in the following calculations. In allowing for monthly payments in this way it is a matter of no consequence whether each payment is increased and then the whole valued as annual payments of the increased amounts, or that the payments are taken at their nominal amounts, and the addition be made to the value arrived at. In the given example I have followed the latter course. The second line is the addition to be made for the interest for the odd months. It is found by dividing the third line by 40, or by 4 placing the quotient one place to the right hand. The second and third lines added give the top line which is the redemption value of the outstanding balance at the beginning of the respective years. (See Table I.)

I wished to shew these lines separately or I would have taken the other plan and increased the annual amounts at once by one-fortieth, and saved these two lines, adding at each column £8·2 instead of £8.

There are several methods for approximating to the present values, but they do not come near enough to the truth, and the value of the error on £100 will always pay for working it out correctly.

Table II contains the most important of the calculations connected with the 20-years 5 per cent. scale of equal repayments. The first column gives the number of the year from the beginning of the mortgage. The balances of the mortgage, and their values all refer to the *beginning* of the year. This is different from the arrangement of the scales in Building Society tables, and the reader must bear this in mind in referring to this table. This arrangement is the proper one for my purpose, as it brings in one line the principals and their corresponding interests, and otherwise I would have had another line in the tables, which line I would have been under the necessity of making No. O, to avoid the pedantry of calling it the zero line. (See Table II.)

Column No. 2 contains the balance of mortgage at the beginning of each year. These balances are given in a decimal form, and are calculated correctly as a 5 per cent. scale; they do not exactly agree with the tables of any Society, but they do not differ much from some of them.

Column 3 contains the interest paid during the year on the balance due at the beginning of that year.

Column 4 contains the principal repaid during the year to lessen the balance due at the beginning of that year.

Column 5 contains the value of the balances owing at the beginning of the year to realise 7 per cent. per annum. This column is for annual payments. These are a repetition in a tabular form of the values arrived at in Table I.

Example. A mortgage for £568 has run 10 years; what is the present value of the remaining payments? At the beginning of the 11th year the value of these payments for £100 of the original sum is 56·59613; this, multiplied by 5·68, gives £321·466, or £321 9s. 4d. for the present value for annual payments.

Column 6 is the same as column 5, but is for monthly payments. It allows 5 per cent. compound monthly interest on the monthly instalments. The first line of this column tells us that to realize 7 per cent. a Building Society ought to pay only £87·0768 or £87 1s. 6½d. for a mortgage of £100 on the 20-years scale. That is, there should be a premium of £12 18s. 5½d. This allows for monthly payments, but supposes the mortgage to run on to the end of the twenty years.

Column 7 is the same as column 6, but it gives the value in per centage of the nominal balance, whereas columns 5 and 6 give the value in per centage of the original loan.

Columns 8, 9, and 10 are similar to columns 5, 6, and 7, but are calculated to realise 6 per cent. to the purchaser. (See Table III.)

Table III is an extension of Table II, showing the effect of a certainty of redemption at the end of the 10th year on an average of all the mortgages. It is not within the scope of this paper to criticise the propriety of valuing outstanding mortgages on this principle. It has been affirmed by practical Building Society men that this is the proper basis on which to establish our calculation, and therefore I have worked out the problem also in this form. It is shewn in column 1 that the premium necessary to yield a 7 per cent. annual dividend is £10 15s. 2½d. This is found by subtracting £89·2397 from £100. And in like manner the premium to realise 6 per cent. is £4 17s. 7½d. The difference in the amount of premium is not so great as has been imagined. Some have taken the very simple rule of considering that the mortgage having only half the time to run, half the premium would be equivalent to the full premium to run the full 20 years. But instead of being 50 per cent. it is 83 per cent. in the 7 per cent. column, and 86 per cent. in the 6 per cent. column. From this it would appear that one-fifth added to the premium received when that premium is £10, and one-sixth when it is £5, will give the equivalent premium to run the full 20 years.

In the reports examined in this paper, I took the premium at £7 10s. per cent., but they did not exceed £6 per cent., so that I allowed about 10s. too much premium even if all the mortgages were to run only ten years. (See Table IV.)

As it is generally supposed that Building Societies are only dividing what is just and proper, and that if they divided less the accumulated profits would become so large that future members would not know what to do with them, I have gone into this question somewhat extensively, and in Table IV I have given the financial history of a Society working without expense and also without fines. This Society I have supposed to lend exactly £10,000 per annum. That is, the *mortgages* are £10,000 per annum; what the capital advanced is depends upon the amount of premiums received; but this does not affect in any way the items in the first six columns. From the second and third columns we get the rate of increase of the Society necessary to enable it to lend the same amount every year. The increase becomes less every year, until in the 20th year the point is reached when the income can just pay the dividend and furnish the money required to advance £10,000, whatever be the premium charged. I have, of course, supposed the premium to continue of the same amount throughout the 20 years, and I have given the state of the funds first on a 7 per cent. dividend, and then on a 6 per cent. dividend.

The last year's income is £16,482; the 7 per cent. dividend is £7,773, and after paying it there is a balance of £8,709, which, to realise 7 per cent. must be lent at £12·923 premium, therefore £8,709 would be lent as £10,001 6s., and the Society could go on for ever lending this amount per annum without adding to its capital account. We have now £1 6s. more lent each year; this slight increase is caused by the increase on the payments in the last year of the scale.

In the same way we may examine the termination of the 6 per cent. column; there is a balance of £9,431 after paying the dividend, and this to realise 6 per cent. will just lend for £10,001 1s.

To approximate to the proper amount of dividend is one of the most important problems in connexion with Building Societies. I have already given a rule for this approximation, and in columns 9 and 13 the results by that rule are placed side by side with the correct amount of dividend. The closeness of the approximation is sufficient for any practical purpose. In applying it to an actual society, the approximation would be still nearer to the proper dividend, for any error in one year would have the effect of improving the degree of approximation in the following year.

Now, here is a Society that has always lent at the full premiums, and has never divided more than the proper dividend, and yet we find no unwieldy balance of undivided profits at the end of 20 years. The difference between the nominal amounts of the mortgages and the capital has been getting relatively less instead of greater. It is easy to see by this table the folly of dividing all the premiums as they come in. As the amount lent each year by this Society never varies, the premiums are also always of the same amount; but in the first year, had they been divided, they would have been shared by members representing only £10,000 of mortgages, but in the 20th year they would be divided among members representing £121,604 of mortgages; and it must not be supposed that the circumstance of its being limited in its action is against the Society, for this Society has no expenses, and therefore the extent of its operations can never affect its proportion of profits. It may be objected to this that actual Societies gain by fines and transfers more than the expenses of the Society. It is not the case. Occasionally there may be a year in the history of a Society in which this is true, but it is very far from being the rule.

The 10th and 14th columns of this table are, perhaps, the most important of them all. They tell us what ought to be the amount of capital corresponding with a given amount of mortgages. A little inspection of the past reports of a Society will enable you to fix its average age to correspond with this table. If its annual lendings have been becoming less, then its age should be taken at more than the actual age of the Society; if they have been increasing, its age should be taken at less than the actual age. In a Society whose age is, say 6 years, and the dividend 7 per cent., the capital, whether the shares of the members or borrowed money, should be only 88.65 per cent. of the total mortgages. That is, at 7 per cent. the whole debts would only fetch 88·65 per cent. of the mortgage balances. (See Table V.)

Table V is an extension of Table IV, supposing the mortgages to be all redeemed at the end of 10 years, although they were originally contracted for 20 years. The heading of the columns, coupled with the preceding remarks on Table IV, will be all that is necessary to make it understood.

It gave me great pleasure to find by one report that the balance of undivided profit in that Society was "about 12 per cent. of the capital stock." I have examined that report to learn how they managed to pay 7 per cent. and yet have such a balance. The Society is called the "Everton and West Derby," and I refer to their report for the year ending May, 1863.

The paid-up Shares amount to	£65,327
Borrowed Money	9,743
Working Capital	75,070
Balance of undivided profit	5,300

Now, I cannot make 12 per cent. out of this by any plan. I have come to the conclusion that they are comparing this balance with the amount of paid up shares, but it ought to be compared with the total capital. But how is it 12 per cent. even of that ? Well, it is about one-twelfth of it, and perhaps that is what is meant, but they in future should say what they mean, as there is a great difference between one-twelfth and 12 per cent. The report of this Society is a very instructive one. In this paper I have not worked in the property tax nor the bank commission. I find that the expenses, bank commission, and property tax, amounted to £567, while the fines, transfers, and forfeitures amounted to £250, so that this Society for that year is £317 out of pocket by management account. In Tables IV and V I have not introduced the working expenses at all, and the money is supposed never to lie in hand, so that in comparing actual Societies with this table an allowance should be made for these. This allowance would quite equal the difference to be made for redemption at the end of 10 years, therefore, instead of working by Table V, we would be nearer the truth to work by Table IV, even with certainty of redemption in 10 years. The "Everton and West Derby" is certainly not of greater average age than an eight year Society in Table IV, and to pay 7 per cent. it should therefore have a balance of undivided profit equal to 10·82 per cent. of the mortgages, that is just about what the report states, 12 per cent. of the capital.

But it should also be remembered that this Society has, in declaring 7 per cent. actually paid 7½ per cent., for the £317 referred to above had also to be paid out of the profits. After apportioning the income, as it ought to be as nearly as the report will enable us to do it, and leaving some margin to be sure to be above rather than under in the result, it appears that this Society did not realise more than 5½ per cent. in the year referred to. In this day's *Mercury* this Society advertises for money on loan at 6 per cent. interest. As long as the members get seven per cent. they will not object to borrowing on preference shares, but the ordinary members will find it rather awkward should a certain point be reached, and the dividends come down to 5, or even to 4 per cent., and no withdrawals can be paid until the loans are cancelled. The ninth report of the "Second Monument" should be studied by all members of borrowing Societies.

It has been objected to my statements that Societies are large borrowers of money at 5 per cent. My answer is, so much the worse for societies as they are at present, and besides, it is illegal for them to borrow at all. In striking the dividend by my rule the effect of borrowed money is justly taken into account, and the dividend gets the full advantage of it if there is any. The objectors do not tell us that they are also large borrowers of money at the bank discounting rate. So much do they depend upon premiums that they will not hesitate sometimes just before a report is issued to borrow from the bank on a promissory note at 8 per cent. to get the premium for the re-lending of it into the report.

The Borough Building Society, Ninth Report.

It has been objected by the promoters of the "Borough" that I have chosen the worst Societies, and that theirs is in a much better financial position. They are willing that it should be publicly examined, and, in justice to them, I will now do so.

In this and in several other Societies we meet with a form of balance-sheet which ought not to be adopted, as it blots out entirely the little information there is otherwise found in Building Society reports, and is a violation of the rule on profits. The interest paid by the Society for money on loan does not appear as an item of expenditure at all. There is an entry on the creditor side, "By interest," which ought to represent the total interest received on outstanding mortgages; but instead of that, it is actually the balance remaining after deducting the sums of interest paid by the Society for the money it has borrowed. In the report of one Society I find, "By interest £386;" but on enquiry I am informed that the interest actually received was £1,037, and that £651 had been paid to the bank for interest, leaving the balance £386. Members of societies should insist on these amounts being clearly and separately stated in every report. Without further information my rule of approximation to dividend cannot be applied to such reports. On application I was informed that the total interest received on mortgages was, in the last year of the Borough, £4,604. In the report we have, "by interest £4,252," the difference, £352, was paid as interest on loans.

In valuing this Society I think it will be fair to discount the mortgages at 6½ per cent., because their premiums are high, and to give it the benefit of redemption in ten years, because they claim it, and to compare it with Table V as a Society in its sixth year, because although actually in its tenth year, its mortgages amount to £93,413; but £30,676 was advanced last year, £27,900 in the preceding year, and £19,500 in the fifth year—I have no more reports. This indicates that the majority of the mortgages are of recent creation, and it may be safely compared with the sixth year of table V. This table gives 6 per cent., and 7 per cent. values only; 6½ per cent. would be nearer 7 than 6. We will take it midway, and thus give the Society the benefit of the error. The value of the mortgages will by this estimate be 93·63 per cent. of the nominal balance.

The liabilities of a Society are the sums paid up on shares together with its debts. The assets should cover these, and should also include a reserve fund equal to the entrance fees on the paid up capital; that is, in the Borough, where the entrance fee is 10s. on an £18 share, there should be a reserve fund equal to 10s. on every £18 in the subscribed capital. The interest of the entrance fees helps the dividend, and when shares are withdrawn the entrance fees on them are taken from the reserve, and are divided with the profits.

When money is lent on a 5 per cent. scale to yield 6½ per cent. per annum, my approximation is to add ·15 of the booked interest to the interest for the sum of the profits, and as this ·15 of the interest is taken from the premiums, this is meant to be the fair proportion of the premiums that should be applied to increase the dividend for that year. This ·15 is one-tenth of the difference between the rate of the scale and the rate realised by the loan, and this is the rule of the approximation. For 7 per cent. take 5 from 7 leaves 2, divide by 10 gives ·2 or one-fifth.

If the mortgages to be valued exceed the liabilities and reserve by the proper amount of discount, this increase of interest should be made as above. But if there is only an excess equal to one-half of the proper discount, then only one-half of this increase should be allowed, and so on.

With these explanations, the following statement of the financial position of the "Borough Building Society" will be intelligible:—

Liabilities	Subscriptions on Shares ..	£74,639		
	Entrance-fees on above ..	2,073		
	Borrowed Money and debts	8,003		
	Dividend due—say	4,500		
	Purchase value of mortgages .... ·9363)	89,215		
	Equivalent mortgages	95,284	£93,413	actual mortgages.
	Deduct............	89,215	89,215	
	Proper amount of discount	6,069	4,198	actual discount.
			·15	
			20,990	
			4,198	
		6069)	62,970	
	Addition to be made to interest....		·104	
	Total interest received........	£4,604		
	Add ·104 of the same	479		
	Total usury	5,083		
	Fines, transfers, rules, forfeitures	187		
	Total revenue		£5,270	
	Interest paid................	352		
	Expenses, property tax, commission and rates	446		
	Total expenditure..........		798	
	Available for dividend		£4,472	
	Rate of dividend paid		7	
	Amount of dividend paid......	£5,060)	31,304	
	Rate of dividend realised......		6·186	per cent.

This is a result much better than I anticipated. There is a deficiency of £1,871 in the discount, but as I started with a dividend amounting to £4,500, and arrived at an available dividend of only £4,472, this reduces the deficiency to £1,842. But again, as they declared a dividend amounting to £5,060 instead of £4,472, this increases the deficiency to £2,430.

From this statement, which is only an approximation, it appears that this Society is in a very favourable position; it is the only Society I have found realising this dividend. It would fetch 20s. in the pound if sold to yield 6½ per cent. to the purchaser, supposing the payments to be gathered in without expense, and that on all mortgages there was certainty of redemption in ten years. The reader may think there is something wrong with it because I have used so many figures to arrive at this result; the most of the calculation has to do with the discount on the mortgages, but in the three societies first examined, the discount is easily dealt with, for there is none, the premiums having been all divided as they came in.

This method of calculation is only an attempt to arrive at the valuation of the actuary without having access to the books of the Society. Were the books open to me it would be an easy matter to arrive at the correct valuation.

I would suggest to those on whom the responsibilities of Building Society management rest that it would not be difficult to construct a *mechanical actuary*. A set of ivory scales, divided logarithmically, as in the common slide rule, but finely divided and of a good size to enable the figures to be read off, and constructed specially for Building Society scales, would enable the auditors to read off the values of all the mortgages in a few hours with sufficient accuracy. One set of scales might be used for all the Societies in Liverpool, and they could well afford to pay for first-class workmanship on it. I have gone into the details of the construction of such an instrument, and I can see no obstacle in the way.

I conclude with a notice of the "Second Monument," a Society which I have named in my notice of the "Everton and West Derby."

The "Second Monument" is a Society now in its tenth year. It has passed through the phases in Building Society existence, more rapidly than most of the other Societies. There has been nothing abnormal in its experience, but only a more rapid development, or, in other words, it has flourished more than they. It has paid high dividends—the same as, or even higher than other Societies, but now it pays only 4 per cent. The following is an extract from its last report:

"The Committee have again to regret the continuous withdrawals during the past twelve months. They hope the members will exert themselves to obtain new shares for the Society, that the profits may be increased by Premiums on Sales. If such exertions are not made, the present rate of dividends cannot possibly be increased, if they are even maintained.

"WITHDRAWALS.

"No Withdrawals will be paid until the Loans now owing by the Society are paid off."

TABLE I.

Year from the commencement	END.	20	19	18	17	16	15
Value of Mortgage at beginning of ea. year..	....	8·43265	15·54331	22·19010	28·40196	34·20744	39·63311
Value of the Interest for the odd months ..	....	·20565	·37901	·54122	·69273	·83433	·96666
Value exclusive of Interest for odd months..	....	8·22580	15·16430	21·64888	27·70923	33·37311	38·66645
	8·80161	16·22580	23·16430	29·64888	35·70923	41·37311	46·66645
	241	552	176	824	360	927	386
	276	175	694	758	399	713	656
	621	688	523	988	782	711	144
	860	460	950	250	333	691	375
	4	320	940	360	120	490	540
			840		130	620	50
Year from the commencement	14	13	12	11	10	9	8
Value of Mortgage at beginning of ea. year..	44·70384	49·44283	53·87180	58·01103	61·87946	65·49482	68·87366
Value of the Interest for the odd months ..	1·09034	1·20592	1·31394	1·41490	1·50925	1·59743	1·67984
Value exclusive of Interest for odd months..	43·61350	48·23691	52·55786	56·59613	60·37021	63·89739	67·19382
	51·61350	56·23691	60·55786	64·59613	68·37021	71·89739	75·18382
	881	273	705	396	417	769	283
	253	596	637	751	960	207	698
	395	619	1028	230	1042	1003	562
	740	841	656	160	791	409	270
	980	920	140		420	880	560
	170	640	330		990	240	
Year from the commencement	7	6	5	4	3	2	1
Value of Mortgage at beginning of ea. year..	72·02188	74·97371	77·73244	80·31070	82·72028	84·97222	87·07682
Value of the Interest for the odd months ..	1·75663	1·82862	1·89591	1·95880	2·01757	2·07249	2·12382
Value exclusive of Interest for odd months..	70·26525	73·14509	75·83653	78·35190	80·70271	82·89973	84·95300
	78·26525	81·14509	83·83653	86·35190	88·70271	90·89973	....
	336	624	893	751	310	529	
	155	895	376	290	962	1019	
	482	390	555	760	1067	567	
	545	699	203	110	1041	323	
	1000	570	960		780	20	
		35			310		

TABLE II.

The Twenty-years' Scale of Repayments, £8 per annum for nineteen years, and £8 16s. on the twentieth year.

1 Year.	2 Balance of Mortgage at beginning of each year.	3 Interest paid during the year.	4 Principal paid during the year.	5 Value of Mortgage balance at 7 per cent., without Interest on Monthly Instalments.	6 Value of Mortgage balance at 7 per cent., including 5 per cent. Interest on Monthly Instalments.	7 Value of £100 of the balance at 7 per cent., including Interest on Monthly Instalments.	8 Value of Mortgage balance at 6 per cent., without Interest on Monthly Instalments.	9 Value of Mortgage balance at 6 per cent., including 5 per cent. Interest on Monthly Instalments.	10 Value of £100 of the balance at 6 per cent., including 5 per cent. interest on Monthly Instalments.
1	100	5	8	84·95800	87·07682	87·077	92·00927	94·30950	94·309
2	97	4·85	3·15	82·89973	84·97222	87·600	89·52983	91·76207	94·600
3	93·85	4·6925	3·3065	80·70271	82·72028	88·141	86·90162	89·07416	94·911
4	90·5425	4·5271	3·4728	78·35190	80·31070	88·699	84·11572	86·21862	95·225
5	87·0696	4·3535	3.6465	75·83653	77·73244	89·275	81·16267	83·19173	95·547
6	83·4231	4·1711	3·8189	73·14509	74·97371	89·872	78·03243	79·98324	95·876
7	79·5942	3·9797	4·0203	70·26525	72·02188	90·487	74·71438	76·58224	96·216
8	75·5739	3·7787	4·2213	67·19382	68·87366	91·120	71·19725	72·97718	96·565
9	71·3526	3·5676	4·4324	63·89739	65·49482	91·775	67·46909	69·15581	96·921
10	66·9202	3·3460	4·6540	60·37021	61·87946	92·457	63·51724	65·10517	97·288
11	62·2662	3·1133	4·8867	56·59613	58·01103	93·165	59·32828	60·81149	97·662
12	57 3795	2·8689	5·1311	52·55786	53·87180	93·886	54·88798	56·26018	98·048
13	52·2484	2·6124	5·3876	48·23691	49·44283	94·631	50·18126	51·43579	98·445
14	46·8608	2·3430	5·657	43·61350	44·70384	95·395	45·19214	46·32194	98·847
15	41·2038	2·0602	5·9398	38·66645	39·63311	96·187	39.90367	40·90126	99·265
16	35·2640	1·7632	6·2368	33·37311	34·20744	97·003	34·29790	35·15535	99·691
17	29·0272	1·4513	6·5487	27 70923	28·40196	97·846	28·35578	29·06468	100·124
18	22·4785	1·1239	6·8761	21·64888	22·19010	98·718	22·05713	22·60856	100·578
19	15·6024	·7801	7·2199	15·16430	15·54331	99·622	15·38056	15·76507	101·045
20	8·3825	·4191	8·3825	8·22580	8·43265	100·651	8·30840	8·51098	101.533

TABLE III.

The Twenty-years' Scale, but with redemption at par at the end of the 10*th year.*
5 *per cent. Monthly Instalment Interest included.*

At beginning of Year.	To Realise 7 per Cent.		To Realise 6 per Cent.	
	Value of Balance of a Loan of £100.	Value of £100 of the Balance.	Value of Balance of a Loan of £100.	Value of £100 of the Balance.
1	89·2397	89·239	95·1216	95·121
2	87·2865	89·986	92·6230	95·488
3	85·1965	90·779	89·9868	95·884
4	82·9604	91·626	87·1860	96·293
5	80·5676	92·582	84·2171	96·724
6	78·0074	93·508	81·0701	97·179
7	75·2679	94·565	77·7348	97·663
8	72·3476	95·781	74·1985	98·179
9	69·2114	96·998	70·4504	98·734
10	65·8562	98·410	66·4775	99·338
11	62·2662	100·000	62·2662	100·000

TABLE V.

The Working of a Society for Ten Years, lending £10,000 *per Annum on the Twenty-years' Scale as in Table IV., but with redemption at par at the end of the tenth year,* 5 *per cent. interest on the monthly instalments is included. The first six columns of Table IV. can be taken with this table for the ten years.*

At beginning of Year.	To Realise 7 per Cent.		To Realise 6 per Cent.	
	Value of total outstanding Mortgages.	Value of £100 of that Balance.	Value of total outstanding Mortgages.	Value of £100 of that Balance.
1	8,924	89·24	9,512	95·12
2	17,653	89·60	18,774	95·30
3	26,172	89·98	27,773	95·49
4	34,468	90·37	36,492	95·68
5	42,525	90·77	44,913	95·87
6	50,326	91·19	53,020	96·07
7	57,853	91·61	60,794	96·27
8	65,087	92·05	68,214	96·48
9	72,008	92·50	75,259	96·68
10	78,594	92·97	81,906	96·89
11	84,821	93·46	88,133	97·11

Becomes uniform after the tenth year.

TABLE IV.

The Working of a Society for Twenty Years, lending £10,000 per annum on the Twenty-years' Scale of Equal Repayments.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
						IF TO REALIZE SEVEN PER CENT.				IF TO REALIZE SIX PER CENT.			
YEAR.	Increase in Mortgages.	Balance of Total Mortgages.	Total Income.	Total Interest.	Total Principal Repaid.	Value of Mortgages atbeginning of year.	Correct Dividend.	Dividend by adding $\frac{1}{5}$th to Interest.	Value of £100 of the Balance.	Value of Mortgages atbeginning of year.	Correct Dividend.	Dividend by adding $\frac{1}{10}$th to Interest.	Value of £100 of the Balance.
1	10,000	10,000	820	520	300	8,707	609	624	87·07	9,430	565	573	94·30
2	9,700	19,700	1,640	1,025	615	17,204	1,204	1,230	87·33	18,607	1,116	1,127	94·45
3	9,385	29,085	2,460	1,514	946	25,476	1,783	1,817	87·60	27,514	1,650	1,665	94·60
4	9,054	38,139	3,280	1,987	1,293	33,508	2,345	2,384	87·85	36,136	2,168	2,185	94·75
5	8,707	46,846	4,100	2,442	1,658	41,281	2,889	2,930	88·12	44,455	2,667	2,686	94·89
6	8,342	55,188	4,920	2,879	2,041	48,778	3,414	3,455	88·38	52,453	3,147	3,167	95·04
7	7,959	63,148	5,740	3,207	2,443	55,980	3,918	3,950	88·65	60,112	3,606	3,627	95·19
8	7,557	70,705	6,560	3,695	2,865	62,868	4,400	4,420	88·91	67,409	4,044	4,064	95·34
9	7,135	77,840	7,380	4,072	3,308	69,417	4,859	4,886	89·18	74,325	4,459	4,479	95·48
10	6,692	84,532	8,200	4,426	3,774	75,605	5,292	5,311	89·47	80,835	4,850	4,869	95·62
11	6,226	90,759	9,020	4,757	4,263	81,406	5,698	5,709	89·69	86,917	5,215	5,233	95·76
12	5,738	96,497	9,840	5,064	4,776	86,793	6,075	6,078	89·94	92,543	5,552	5,571	95·90
13	5,225	101,722	10,660	5,346	5,314	91,738	6,421	6,415	90·18	97,686	5,861	5,880	96·03
14	4,686	106,408	11,480	5,600	5,880	96,208	6,734	6,720	90·41	102,318	6,139	6,160	96·15
15	4,120	110,528	12,300	5,826	6,474	100,171	7,012	6,989	90·62	106,409	6,384	6,409	96·27
16	3,526	114,054	13,120	6,022	7,098	103,592	7,251	7,227	90·83	109,924	6,595	6,625	96·38
17	2,902	116,957	13,940	6,187	7,753	106,432	7,450	7,425	90·99	112,831	6,769	6,806	96·46
18	2,247	119,205	14,760	6,320	8,440	108,651	7,605	7,584	91·15	115,091	6,905	6,952	96·55
19	1,560	120,765	15,580	6,418	9,162	110,206	7,714	7,701	91·26	116,668	7,000	7,060	96·61
20	838	121,604	16,482	6,480	9,920	111,049	7,773	7,776	91·32	117,519	7,051	7,128	96·64

Becomes uniform after 20th year.

ELEVENTH ORDINARY MEETING.

Royal Institution, 21st March, 1864.

JAS. A. PICTON, Esq., F.S.A., President, in the Chair

Mr. **Moore** exhibited a fine stuffed specimen of the Swordfish (*Xiphias gladius*), recently added to the Derby Museum. It measured nine feet in length, and was taken in October, 1862, by some men in the employment of Mr. Wiseman, oyster merchant, in a small creek near Paggleshams, a few miles from Southend, Essex. It was floundering about apparently in an exhausted state. A short notice of its capture is printed in the *Zoologist* for December, 1862, p. 8289.

Mr. **Turner** exhibited from the Museum of the Royal Institution a portion of the hull of a ship, in which was imbedded the sword, or *gladius*, of a fish of this family, apparently of the genus *Histiophorus*.

The **President** pointed out the special adaptation of the form of the body and tail of the fish for rapid progress through the water, and for producing the momentum necessary for such effects as that shewn by the piece of timber exhibited by Mr. Turner, and of which several examples are known.

Mr. **Moore** also exhibited the first portion of a collection of specimens of marine zoology, made during the voyage, just completed, from Liverpool to Shanghai and back, by Captain F. E. Baker, ship Niphon, an Associate of the Society. The entire collection, contained in upwards of fifty bottles, had been most kindly presented to the Derby Museum by Captain Baker. It consists chiefly of the smaller and more minute forms of marine life, which though often occurring in considerable abundance, are so rarely collected and preserved. The specimens exhibited consisted of two species of *Janthina* and their rafts, a beautiful specimen of a rare Cephalopod, *Branchia scabra,* two species of *Velellæ,* a beautiful little *Physalia,* or Portuguese "man of war," several species of *Ericthys,* &c. Additional specimens will be exhibited at future meetings of the Society, and a more detailed list given, accompanied by the notes of Captain Baker.

A paper was then read:—

ON THE CHARACTER OF HAMLET, HAVING ESPECIAL REFERENCE TO HIS TREATMENT OF OPHELIA.

BY P. H. RATHBONE, ESQ.

TWELFTH ORDINARY MEETING.

ROYAL INSTITUTION 4TH APRIL 1864.

JAS. A. PICTON, ESQ., F.S.A., President, in the Chair.

Mr. F. **ARCHER**, Jun., exhibited some beautifully preserved specimens of the larvæ of butterflies and moths, prepared by Mr. Baker at Cambridge. The life-like appearance of these specimens attracted considerable attention. He stated that these were the first of the kind which had been seen in this country, and he read a passage from the *Zoologist* for 1856, in which Dr. Collingwood had described the process by which they were prepared.

Dr. **COLLINGWOOD** said he had been struck by the exhibition of such objects in the Imperial Cabinet of Zoology in Vienna, in 1855, and was informed by the director, Herr Redtenbacher, of the method of preparation employed, which he had afterwards communicated to the Entomological Society. It did not appear that until now any English entomologists had attempted the preparation of such insects, which was a difficult operation; and he hoped that the present specimens would be added to the Free Public Museum.

Mr. **PICTON** added that he thought he might say that such would be the case.

The Rev. H. H. **HIGGINS** exhibited some completely fossilised fragments of bones, apparently of large animals, which he had found in a gravel pit by the river Ouse, at Biddenham, near Bedford. They were taken from a place near which a flint implement had been discovered a short time before, at the bottom of a bed of sand about eleven feet below the surface of the soil.

A paper was then read, entitled :—

A NOTICE, BY MR. OLIVIER BEAUREGARD, OF THE COLLECTION OF EGYPTIAN ANTIQUITIES MADE BY DR. GODARD, AND PRESENTED TO THE MUSEUM OF BORDEAUX IN 1862.

BY WILLIAM UNWIN, ESQ.

This paper was an analysis of Mr. Beauregard's book, which consists of an account of the labours, fatigues, sufferings, and death of that devotee of science, in Egypt and Palestine, whither he had gone on a scientific mission from the French Government to study diseases peculiar to those regions; also, a description of Dr. Godard's collection of objects of archæological interest, and which consists of—Stelès, or funereal tablets; papyri; mythological figures, and emblems of the religion of the Egyptians; funereal statuettes; Scribes' pallettes; fragments of mummies and bandages; tokens and coins of Greco-Romanic times; objects from Modern Egypt, such as vestments worn by ladies of the harem, and an account of their religious emblematical signification. Mr. Beauregard's opinion was, that the Egyptians had, behind all their idols, emblems, and symbols, a much purer religion than hitherto they have credit given them for. He believed that the Christian religion itself, if judged of from the material diagnosis it presents when studied in the sculptures of our temples (Notre Dame of Paris, for example), pictures, and statues, would be seriously misinterpreted. The paper concluded with an imaginary report which might be made by a commission of the Institute of a nation to arise 4,000 years hence, and which, after obtaining a key to the French language, had come to France to study from the sculptures, &c., in the temples, the religion, morals, and manners of the French.

A second paper was also read, entitled:—

THE GOOD OLD TIMES.

BY D. BUXTON, ESQ., F.R.S.L,

THIRTEENTH ORDINARY MEETING.

Royal Institution, 18th April, 1864.

J. A. PICTON, F.S.A., President, in the Chair.

Messrs. Hermann Fischer and Joseph Burne were balloted for, and duly elected ordinary members.

Mr. Moore exhibited several interesting specimens of animals lately added to the museum, including an example of the Bohemian Waxwing (*Bombycilla garrula*), lately obtained in the neighbourhood; and also several curious marine worms and entomostraca.

A paper was then read:—

ON THE PRINCIPLE OF EQUALITY IN DIRECT TAXATION.

BY A. COMMINS, LL.D.

FOURTEENTH ORDINARY MEETING.

Royal Institution, 2nd May, 1864.

J. A. PICTON, F.S.A., President, in the Chair.

It was announced that the Annual Dinner of the Society would be held some time about the end of the present month, at a time and place to be arranged by the Committee.*

Dr. J. E. Gray, F.R.S, of the British Museum, and Professor Rolleston, F.R.S., of Oxford, were proposed as Honorary members of the Society, on the recommendation of the Council.

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* The Anniversary Dinner was celebrated at Childwall Abbey on Thursday, June 2nd, and was very successful. The only drawback was the absence of his Worship the Mayor, Charles Mozley, Esq., who was prevented from being present by severe indisposition.

Mr. J. J. Stitt was balloted for and elected an ordinary member.

Mr. MOORE exhibited a singular organic structure, from the Free Public Museum, which had been submitted to Dr. Gray for examination, and by him had been described before a late meeting of the Zoological Society of London, as indicating a new group of radiated animals nearly allied to Asterias, but forming a new family, for which he proposed the name of *Myriosteonidæ*, and for the specimen itself the name of *Myriosteon Higginsii*, after the Rev. H. H. Higgins, by whom it had originally been obtained from a dealer. The specimen will be deposited in the British Museum.

Mr. MOORE next exhibited the bones of one of the flippers of a rare Cetacean (*Megaptera longimana*) which was stranded in the Mersey, near Speke, in July, 1863, and the skeleton of which, now mounted for public exhibition, was presented to the Free Public Museum by Mr. Thomas Brock. A fine stuffed specimen of a Chimpanzee was also exhibited by Mr. Moore. It differed considerably from ordinary examples of the Chimpanzee, in being entirely black, with the exception of a few white hairs on the chin. It belongs to Mr. Hulse, in whose possession it lived a considerable time in 1863.

A paper was then read, entitled :—

A COMPARISON OF THE HAND, FOOT, & BRAIN, IN MAN AND THE CHIMPANZEE.

BY PROFESSOR ROLLESTON, F.R.S., UNIV. MUS. OXFORD.

(*Communicated by Mr. T. J. Moore.*)

This paper was accompanied by elaborate dissections of the parts described, made by the author, and presented by him to the Museum.

The following paper was also read :—

ON A NEW SPECIES OF CHÆTOPTERUS,

(*In a letter to T. J. Moore, Esq.*)

BY JOHN WILLIAMS ESQ., BEAUMARIS.

I first found *Chætopterus* at Beaumaris in December 1859, and have since met with plenty of them. In one spot they especially abound. I find them in hard, smooth sand and gravel, among Boulders. They lie very far down, and can only be obtained on a low spring ebb.

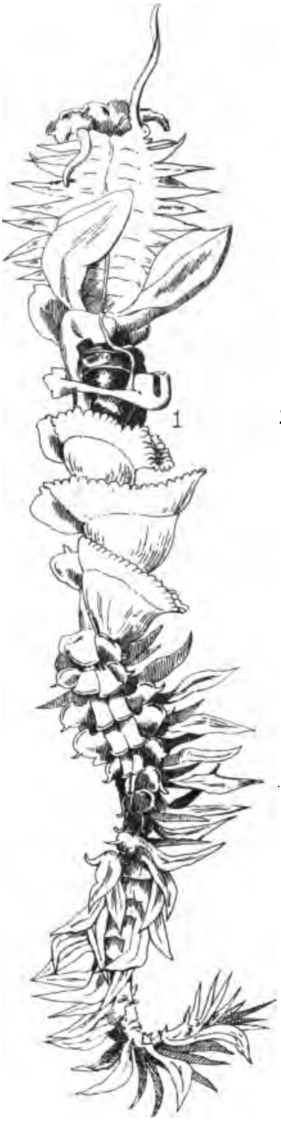
Both ends of the tube project from half an inch to a couple of inches above the surface of the ground, but they are often hidden by tufts of sea-weed growing upon them. The two ends are usually about a foot apart. I make it a rule to find both ends before I begin to dig, otherwise I should probably cut the tube in two. When therefore many tube ends are to be seen, great caution is necessary. Two appearing within six inches of each other indicate two tubes, unless they are very small.

I find great variety of size. Some tubes are not above eight inches long, and lie with their ends not three inches apart. Others are more than two feet long, and broad in proportion. In both the annelid is precisely the same in every respect except size; and I have always found the same parasite in either tube, but smaller in a small tube.

Here the tubes are less tough and leathery than in the South Carolina specimen in your Museum; but they are very thickly coated with adherent gravel and pebbles, which is not the case with that specimen. They are all made in horse-shoe form, just as they lie in the earth; and they cannot be stretched out straight without tearing that side which when *in situ* is the uppermost. I have found one passing under a large stone, one end appearing at the surface on either side of it. It is not unusual when two tubes lie very near together, to find them adhering to each other; but I never find any communication between them. So, sometimes a tube is found which has a short length of similar structure fast to it. Here also I find no sort of internal communication, and the extra length, having only one outlet, is always disused and full of sand.

On one occasion I spent fully half an hour watching the tubes *in situ*, while there was still a few inches of water over them. I saw no movement whatever; no head projected, no apparent flow of water into or out of them; and no sign of their being tenanted. I have kept them alive for a week in a tank, both in and out of their tubes. Those in tubes sometimes come up to the top and project the head and tentacles: they retire quickly when touched. Those on the gravel move but very little. I have never seen them attempt to burrow, to make a new tube, or even to move away; but they are sensitive, and shrink when touched. The three lobes of the body are in constant slow, wavy motion, as if their skin acted as branchiæ. The feet also, beneath the segments of the tail-half of the body, frequently move; each of the two series in its proper direction. The pairs of feet which are placed in the centre of each segment, and the posterior side of the disks which answer the same purpose in respect of the lobes, stomach, and head, are so placed as to work the annelid *backwards*. While the outer rows of feet—which bear small cirri—and the anterior halves of the disks above mentioned, work the body *forwards*. The action of these members must be materially assisted by the very remarkable comb-like bristles with which they are provided.

So far as I have been able to ascertain by dissection, the head has no evertile proboscis, nor any jaws. It contains a cup-like mouth, opening vertically when the annelid is at the



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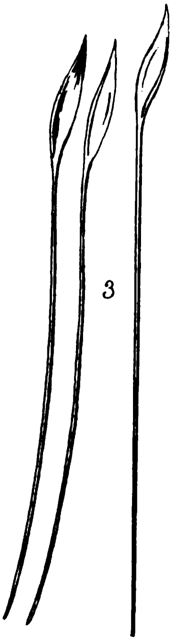

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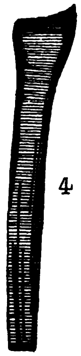

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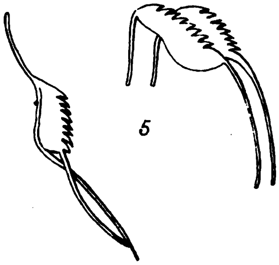

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1. CHÆTOPTERUS .... NATURAL SIZE.
2. BRISTLE FROM TAIL SEGMENTS AND LONG PROCESSES ON HEAD ...... MAGNIFIED.
3. BRISTLES FROM LATERAL HEAD-PROCESSES. ,,
4. BRISTLE FROM FOURTH LATERAL HEAD-PROCESS. ,,
5. BRISTLES WHICH FORM THE FAINT LINE ON FEET AND DISKS. ,,

mouth of its tubicular home, and having a lip round nearly the entire circumference, and leading into a wide throat, the inner surface of which is roughly ridged. But I find no tongue, jaws, nor teeth in it. On the upper side of the head, the lip is cut, and at each end of the opening springs a very lithe and active tentacle, thick, obtuse, rounded on the upper side, furrowed beneath. The edges of this furrow can meet so as almost to form a tube. Just at the root of each tentacle is a dark spot which looks like an eye. I fail, however, to convince myself that it possesses any powers of vision, or to trace any nervous system in connection with it.

On each side of the head the golden feet, or lateral processes are nine in number, formed of bristles clothed with flesh. On the fourth of each series there is a group of bristles quite different in form and colour from the others. I should much like to know their use, as well as that of the open bag which is placed upon the back of the annelid.

Bristles I find of four distinct kinds. In the two long processes like asses' ears, and in all the segments of the tail, the bristles are long, golden, straight, plain, and taper to a plain point. In all the processes on each side of the head they are somewhat shorter, golden, straight, or very slightly curved, truncate at the inner end, and tipped at the other with an elegant "spearhead," slightly bent to the form of the process. These "spearheads" overlap each other, and must give additional strength. On the lower part of the fourth lateral head-process appears a set of different bristles, short, thick, dark-coloured, truncate at both ends, almost club-shaped. The most remarkable of the bristles are those which, placed side by side in immense numbers, form the faint brown line observable along the edges of the feet and disks beneath the body. They are comb-like, having eight sharp teeth, and are firmly embedded in the flesh by a long tendon. The teeth of the combs are turned in the direction in which the feet respectively bearing them are required to act. The number of these little saw-teeth bristles in each Chætopterus must be enormous, for many have forty segments in the tail portion, each segment having four feet (two to work each way.) I estimate that on each foot there may be a hundred of these combs—if so, the tail portion of the annelid would bear about 16,000 of them; and the disks and lobes half as many more, perhaps.

In every tube which contains a Chætopterus, without exception, I find a parasite—an annelid which corresponds with the description of Polynöe given in Mr. Gosse's Manual. It has bristles of one sort only, (long, pointed, toothed like a saw on one edge at least.) It has antennæ and two pairs of eyes. Its segments are alternately provided with soft appendages, (in this case the appendages are alternately shield-plates and cirri.) It has two pairs of teeth or jaws in an evertile proboscis. In large tubes the parasite is large; in small ones, small. I generally find it crouching on the lower segments of the body of Chætopterus: and the earliest intimation I receive of the death of that annelid, is from the exit of the parasitical Polynöe from the tube.

Your South Carolina specimen seems to have a crab parasite.

Near these Chætopteri I find various Terebellæ; Cerianthus; Sabella; Mya in great numbers; and a very large Pholas, buried at least a foot and a half in hard soil or clay, and having siphons, the open ends of which, at the surface of the ground, measure nearly two inches across. If you would like to have specimens of these, let me know and I will send you some when the tides ebb low enough to reach them.

The following paper was also read:—

THE HISTORICAL FAUNA OF LANCASHIRE AND CHESHIRE.

BY CUTHBERT COLLINGWOOD, M.B., F.L.S., &c.,
Foreign Member of the Royal Physico-Economical Society of Königsberg.

IN the last volume of the Proceedings of this Society I published a paper on the *Ancient Fauna of Lancashire and Cheshire,* in which I endeavoured to obtain a glimpse at the past inhabitants which, in geologic ages successively peopled the region we now call the counties palatine of Lancashire and Cheshire,—as far as such a glimpse could be derived from the mutilated remains spared to us from the carboniferous and triassic rocks. In that paper I purposely abstained from entering upon any records of the historic period, reserving these for a future opportunity, which has now arrived. Should a new and elaborated edition of the Fauna of Liverpool ever be prepared, I venture to think that that paper would prove an interesting and appropriate introductory chapter; and the paper I am about to present is a supplement to it—a *second* introductory chapter to our local Fauna. In it I propose to bring forward, collected from every available source, the records of the appearance in our two counties of animals either rare at all times or which have at intervals appeared there, and thus left traces of their existence in the note-book of zoological observers. For in studying the Fauna of any district, attention should be directed not only to the every-day appearance of characteristic or dominant species, but also to the casual appearance of visitors, which from any cause have been drawn to the spot; since, for every such unwonted visitation there has doubtless been some natural reason; and while such visits invest a district with unusual zoological interest, it must also be borne in mind that what has happened once, *may* happen again; and it is at all events more probable that an animal which has *once* been observed, may visit us again, than that we should meet with one which has never been seen amongst us.

In the records of local Natural History observation, certain districts stand out conspicuously, from the accident of some ardent lover of nature having lived upon the spot, whose chronicles have rendered the place classical in zoological annals. Such districts are Hants and Sussex, celebrated by the diligence of such men as Gilbert White, and of Markwick; such a region also is the Dorset and Devon coast, which the indefatigable Col. Montague scoured so thoroughly—and such may be called the Cornish coast, which has boasted a Borlase, and still boasts a Couch, and a Spence Bate. Such districts yield ample proof that it requires careful and continued observation to develope the riches of a given locality; and were the same test applied to other localities they doubtless would not be behindhand in affording an interesting and extended historical Fauna. Antiquarians and naturalists too, have existed in most counties, who have collected information of greater or less value, relative to many parts of the country, and few of the older topographical works were regarded by their compilers as complete, without some account of the natural productions of the district described. But, still the value and extent of these sections of such works depend upon the character of the investigations which had been carried on by previous observers, and are most complete where such observers have been most numerous, accurate, and painstaking. Such works as Camden's *Britannia* also, contain scattered notices of the botany and zoology of the country, and occasionally give curious information as to the productions which have from time to time been met with.

The chief works relating specially to the counties palatine, which have been found to yield information upon these topics, are Leigh's "Natural History of Lancashire," and Ormerod's "History of Cheshire." Of these the former is an old work, published in 1705, and contains numerous notices of great interest upon the Fauna of the county, but usually couched in quaint language, and describing the animals under peculiar names, which the modern zoologist has to translate into recent systematic phraseology, a task in which, however, he is aided by good plates. Ormerod's "History of Cheshire," published in 1819, is a much more voluminous work, but contains but few references to this department of local history, and the information derivable from it on this head is remarkably meagre. The former, however, professes to be a Natural History of the County, while the latter is a purely topographical work, of which almost the sum total of its zoological information is to be gleaned from the notices of the ancient forests of the county. The same may also be said of Mortimer's "History of Wirral." We have some brief notices in Pennant's Tour which possess a certain interest, and Leland's Itinerary touches upon some districts in our counties, a work, which having been written in the early part of the 16th century, cannot be otherwise than useful for our purpose.

The ancient condition of the two counties can scarcely be realized at the present day, when they are by no means remarkable for the growth of fine *timber*. Forests then abounded both in Lancashire and Cheshire, but more particularly in the latter county. The entire Hundred of Wirral was formed into a forest by Randle (Ranulphus) Meschines, third Earl of Chester, but was disafforested in the reign of Edward III, and twenty marks per annum allowed to the Stanleys in lieu of the profits of their office. Hence we see the truth of the old distich—

> "From Blacon point to Hilbree
> The squirrel might leap from tree to tree."

The Earl of Chester had originally five forests; one of them is noticed in Domesday in Atiscros Hundred, ten miles long, and three broad, and contained four aeries of hawks; but it is not noticed in any subsequent documents. The other forests were Wirral, (as above),—Mara and Mondrem, (of which the present Delamere forest is the remains,) and which with Macclesfield, were forests in the popular sense of the word as late as the time of the great rebellion, and even then abounded in vert and venison. The barons of Nantwich also had a forest called Cohul on the banks of the Weaver, probably near Coole Pilot, as well as the chase of Ulreswood (Ulresford) in the barony of Dunham. "The hole foreste of Maxwel except it be a smal spek is yn Chestre," (Leland, iii, 42).

Moreover, the Conqueror* is said to have possessed in different parts of England 68 forests, 13 chases, and 781 parks; and for the better undertanding of what forests were at that period, we may quote the description of Manwood, the great authority on the forest laws, who defines a forest as being "a certain territory or circuit of woody grounds and pastures, known in its bounds, and privileged, for the peaceable being and abiding of wild beasts, and fowls of forest, chase and warren, to be under the king's protection for his princely delight; replenished with beasts of venery or chase, and great coverts of vert for succour of the said beasts, for preservation whereof there are particular laws, privileges, and officers belonging thereunto." And with regard to the kind of animals to be so succoured,—the beasts of park or chase, according to Coke, are properly the buck, the doe, the fox, the marten, and the roe; but the term in a wider sense comprehends all the beasts of the forest.* Beasts of warren are such as hares, conies and roes; fowls of warren, such as partridge, quail, rail, pheasant, woodcock, mallard, heron, &c. He adds "beasts of forest be properly hart, hind, buck, hare, boar, and wolf; but legally, all wild beasts of venery." (Co. Litt., sec. 387). The oppressive character of the forest laws was at length relieved by the action of the Long Parliament in the reign of Charles I.

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* William had a summary method of increasing the forest lands: no need of planting trees or waiting for the slow growth of oaks and beeches. There were then many woods in merry England, and he simply swept away the homes of the villagers who dwelt among and near them, so that the lands returned to their natural state of wildness, and the stag crouched undisturbed on the hearth of the peasant, or in the long fern where once was the altar of the village church." *Reed's Lectures on English History*, p. 63.

If we go back to a yet earlier historic age, we may still find records, which, although meagre and of a general kind, are no less interesting as affording us presumptive evidence of the nature of the Fauna of such well-wooded counties as Lancashire and Cheshire have at one time been.† In the "Archæology of Wales" is printed a Triad, or poem of three-lined stanzas, from the Book of the Triades—in British, *Trioedd Ynys Prydain*, or the threes of the island of Britain—which seems to have been written about the year 650 A.D. (Yorke's Royal Tribes of Wales, p. 69). It is said to be from a MS. dated 1601, wherein the writer states that it was taken out of the books of Caradoc of Llancarven, who lived in the 12th century—the authenticity of these documents is therefore indisputable. From this authority we learn that the Kymri, a Celtic tribe, first inhabited Britain, and that before them, were no men here, but only bears, wolves, beavers, and oxen with high prominences, often mentioned by the Romans, as by Claudian, Martial, &c. Plutarch relates that *Bears* were taken to Rome from Britain and there excited great admiration. In the Penitential of Archbishop Egbert, said to have been composed about the year 750 A.D., bears are also mentioned as inhabitants of our forests; but the laws of Canute, enacted 270 years after, are silent concerning them; though in Domesday book they are cursorily mentioned. In England, *wolves* are alluded to for the last time in the reign of Henry IV, though Hollinshed tells us that in Scotland they committed great havoc in 1577. The last wolf on record in Britain was killed by Sir Ewan Cameron of Lochiel, in 1680, (Sir Oswald Mosley in the *Zoologist*, ii, 710), though in Ireland they existed as late as 1710. With regard to *Beavers*, in the Itinerary of Archbishop Baldwin by Giraldus de Barri A.D. 1188, we read, "The (river) Teivi has another singular particularity being the only river in Wales, or even in England which has beavers; in Scotland they are said to be found but in one river, but are very scarce." Sir Robert Hoare, from whose edition of Giraldus Cambrensis (p. 49) we quote, adds to this account (p. 57) "That the Beaver was an extremely scarce animal in Britain may be collected from the laws of Howel Dda, (Leges Wallicæ, 261) where it appears that even in those early days, when the skins of the stag, wolf, fox, and otter, were valued at only eight-pence apiece, the white weasel at twelve-pence, and the marten at twenty-four-pence, the skin of the beaver (Croan Llostlydan, that is the broad-tailed animal) was estimated at the exorbitant price of one hundred and twenty-pence." But, he further suggests that, if this Castor of Giraldus and the Avanc or Afangc, of Humphrey Llwyd, are the same animal, it could not have been peculiar to the Teivi, since there are many places whose etymology is derived from the latter name; but probably the *otter* was the animal referred to by the latter writer. Further, Camden tells us that at Low Furnis in the north-west of Lancashire, the forests abound with Deer and *Wild Boars*, (iii, 142); and speaking of *Salfordshire*, Leland says (vii,

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* Wild cats were also reckoned among beasts of chase, as appears by the charter of Richard II to the Abbot of Peterboro', giving him permission to hunt the hare, fox, and *wild cat.*

† For the antiquity of the royal forests in England, "the best and surest argument (says Coke, 4, Inst. 319) is that the forests in England being 69 in number, except the New Forest in Hampshire, erected by William the Conqueror, and Hampton Court Forest by Henry VIII, are so ancient as no record or history doth make any mention of their history or beginning."

49,) "Wild Bores, Bulles and Falcons bredde in times past in Blakele."*

It may easily be believed that in later times when such wild and destructive animals as bears, wolves, and wild boars had been exterminated, the forests would abound with beasts of the chase. The way in which Leland (iii, 42) speaking of the forests, and chacys and parkes in Chestershire, refers to the "fayre and large forest of Delamare, besides the wich I remember none, and there is plenty of redde deere and falow," (see Camden ii, 434) may, probably, be taken as representing the condition of all those parts of the country which had escaped disafforestation; for Delamere, although this fate was contemplated for it in the reign of Charles I, was not disafforested till 1812. Leland, however, wrote in the twenty-seventh year of the reign of king Henry VIII, but if we may judge from a document of the date of 1626, the profits accruing from similar sources a hundred years later were by no means very considerable. In a letter from Sir John Dene to the commissioners of Forests (Harleian M.S.) we find—"Particulars of profits appertaining to my office of forester and bailiff of Delamere Forest—

The sparrow-hawks and hobbies . . .	0	0	0
The benefit of bees taken within the forest, rated communibus annis, per annum .	5	0	0
My privilege to keep greyhounds, and to course and kill hares and foxes, within the forest—not rated	0	0	0

(Ormerod's Cheshire.)

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* My object in this part of the paper has been to shew the kinds of beasts which probably overran most of England in historic times, and although I cannot quote instances of their having been found in these counties, it may be assumed that they inhabited this neighbourhood as well as the rest of England. The following additional references may be found useful by those interested in the subject.

Bears. Dissertation annexed to the Essay on the coins of Cunobelin, p. 126. Dissertation on the Coritani, p. 349. Archbishop Ussher's Antiquities, pp. 28, 53 and 91. Dugdale's Warwickshire, p. 298. Pennant's Zoology, I, 90.

Wolves. Dr. Caius de Canibus Brit., p. 499. Pennant, I, 88.

Wild Bulls. Archæologia, iii, 7. Fitzstephen's Description of London, 1772, p. 26.

Wild Boars. Essay on the coins of Cunobelinus, pl. ii, class 4, p. 98. See also Archæologia, x, p. 162.

Later on, the glory of Delamere had departed, and Pennant in his Tour describes it as "now a black and dreary waste; it feeds a few rabbets, and a few black Terns skim over the splashes that water some parts of it." (i, 3).

But in the very nature of things this change must come about, and in a county formerly noted for its great forests we are told by Smith, writing in the reign of Queen Elizabeth, of "the great store of *parks*, for every gentleman hath his own park."

It is probable that this park-like aspect was partaken by the county of Lancashire, and that hence that county was long remarkable for its breed of cattle. Pennant calls attention to this fact in the following manner:—"The spectator (says he) has long since pointed out the knowledge which may be collected from signs—it is impossible not to remark the propriety of the reigning one of this county (Lancashire); the triple legs, and eagle and child, denote the great possessions of the Stanlies in these parts,—*the bull, the just pre-eminence of its cattle over other counties*; and the royal oak, its distinguished loyalty to its sovereign." He goes on to observe, "I am amazed they do not add the *Graces*, for no where can be seen a more numerous race of beauties among that order who want every advantage to set off their native charms." (Tour, ii, 21). Drunken Barnaby, as he was called, who lived at the end of the 17th century, and published his four Itineraries in Latin Rhyme, celebrates at once the cattle and their treatment of him, as follows:—

"Veni Garstang ubi nata
Sunt Armenta fronte lata,
Veni Garstang, ubi malè
Intrans forum bestiale
Forte vacillando vico
Huc et illuc cum amico,
In Juvencæ dorsum rui
Cujus cornu læsus fui."

Garstang, observes Pennant (Tour, i, 284), seated on a fertile plain, is bounded on the east by the fells, and on the west by Pelling Moss. The adjacent country is famous for producing the finest cattle in all the county. A gentleman in that neighbourhood has refused thirty guineas for a three-year old cow; calves of a month old have been sold for ten, and bulls for seventy to one hundred guineas, which have afterwards been hired out for the season for thirty. In his "Zoology," he gives a figure of a *Lancashire cow*, but without any description. The Lancashire breed of oxen was ultimately superseded by the Leicestershire, which, however, is only the same blood improved by careful selection.

Dr. Leigh, in his "History of Lancashire," says, that "in a park near Bury, are wild cattel belonging to Sir Ralph Ashton of Middleton; these I presume were first brought from the Highlands of Scotland. They have *no horns* but are like the wild bulls and cows upon the continent of America." These certainly must have been very different from the local breed, for Bell tells us (History of British Quadrupeds, p. 420) that "the *long horns* originally, so far as our country is concerned, came from Lancashire."

Perhaps, next to cattle, the most important animals to man are those belonging to the order of fishes, on account of their great numbers and value as articles of food; and no fish has been more considered, or is worthy of more consideration in an economical point of view, than the Salmon. Bearing in mind the present state of the salmon fishery in our own river, (which is *nil,*) it is interesting to know its condition three-quarters of a century back. "The salmon fishery" (in the Mersey) says Pennant (Tour, ii, 212) "is very considerable, but the opportunity of sending them to London and other places at the *beginning of the season* keeps the price to about 8d. per pound, which gradually sinks to 3d. or 2½d., to the great aid of the poor manufacturers." And Ranulphus Cestriensis, speaking of the plenty which characterised the county of

Cheshire, says that it abounds with plenty of all kinds of provisions, corn, flesh, fish, especially *excellent Salmon.*

A correspondent, writing to *Loudon's Magazine*, thirty years ago (vii, 202), gives the following information with regard to the salmon fishery in the neighbouring river Ribble. He describes four kinds—1st. The Salmon, which varies in weight from 5 to 30tbs. Fresh fish never make their appearance before May; a few come during June, July, and August, but from the latter end of September to the end of December, they run up very freely. Some of the male kippers (kelts) come down in December and January, but the greater part of the females remain in the river until April, and are occasionally seen herding with shoals of Smelts in May. 2nd. The Mort, which he supposes to be *young Salmon*, weighing 1½ to 3tbs. 3rd. The Sprod, which is the whitling, whiting, or berling of Scotland, weighing only 6 to 8oz., and ascends the river in July, disappearing in September; and 4th. The Pink or Par (also young Salmon,) weighing 1 to 3oz. The largest are all males, and in them the milt is large in October.

Smelts also, (*Osmerus eperlanus*) or as they are called in the North, sparlings, migrate, says Pennant, up the Mersey in spring, in amazing shoals, and of a size superior to those of other parts, some having been taken that weighed half-a-pound, and measured thirteen inches. This, he elsewhere says, was the largest he ever saw. (Zool. iii, 417). In his Zoology, he remarks that they were taken in the Dee as early as December, though they do not spawn till March or April; and that it had been observed that they never came into the Mersey as long as there was any snow water in the river.

In the Mersey, also, was found a small fish called the Graining, (*Leuciscus Lancastriensis*), a fish peculiar to our county, in some respects resembling the dace, yet a distinct species. Its usual length is 7½ inches. It is rather more slender than the dace, the body almost straight, colour of the scales silvery with a bluish cast, while those of the dace have a yellowish or greenish tinge. The eyes, and the ventral and anal fins of the graining, are of a pale colour. It was first noticed by Pennant in the Mersey near Warrington, the only other locality given for it being the river Alt, which runs by Sefton. At present it appears that the graining is common in the Weaver, where the dace is scarce, while in the Alt, where the dace abounds, the graining is not commonly met with. (Byerley's Fauna, p. 28.)

Singularly enough, another species of the genus *Leuciscus* appears to have been first met with in, and peculiar to, our county, viz., the Azurine (*Leuciscus cœruleus*), of which Yarrell received specimens from the township of Knowsley, and described it, and the last, in a paper in the 17th Vol. of the Linnæan Transactions.* This fish is termed locally *blue roach*, and, until described by Yarrell as above, was an unrecognized species, though both it and the graining were known to Professor Agassiz as inhabiting some Swiss lakes, but they had not been described by him. Mr. Byerley obtained specimens of the Azurine from a pit at Croxteth.

Another fish deserves especial mention, although found only upon the outskirts of this county, viz., in Windermere Lake, which divides Lancashire from Westmoreland. This is the Char, (*Salmo salvelinus*, Linn.; *S. umbla*, Jenyns,) a fish abounding in the cold Lapland lakes. Leland says, (vii, 63) "Wyner-mere wath (water ?) wherein a straunge fish called a *char*, not sene else there in the country as they say." But, Pennant, in his Tour, assures us that Winander-meer, Llyn Quellyn at the foot of Snowden, and Llynberis, as well as certain lakes in Merionethshire and Scotland, contained this fish, though in Llyn Quellyn and Llynberis, the copper works had, in his day, entirely destroyed them. 'The largest and most beautiful (he says) are taken in Winander-mere, distinguished into the *case,* the *gelt* or *barren,* and the *red char.* The former spawn about Michaelmas, chiefly in the river Bratby, which has a black stoney bottom, and are in the highest perfection in May through the summer. The gelt char spawn from January to March, and keep in the smooth sandy parts of the lake, and are taken from the end of September to the end of November, and are esteemed more delicate for the table, especially potted. The spawning season of the Westmoreland chars agrees nearly with that of the Welsh ones, which from their colour are called *torgoch,* or red-belly, the other being paler." (See Gough's Camden, iii, 144.)

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* Yarrell's original MS. description is in our Museum.

Lacepède (Histoire des Poissons, vol. iii, p. 70) refers to a species of cod under the name of *Le Gade négre,* caught in the firths of Clyde and Solway, and also in the Mersey. He says, it grows to the length of eight inches or a foot; the lower jaw is longest, and provided with a beard; two long filaments distinguish each ventral fin, and the first dorsal consists of only one ray, which is jointed. Modern Ichthyologists, however, regard this, as well as the rock or red cod found off the Isle of Man, as simply varieties of the common codfish (*Gadus Morrhua.*)*

Dr. Leigh claims for the eels near Manchester a quality superior to those of other parts, for says he, "The river Eske is remarkable for eeles, which I think I may affirm to be the fattest in England, and indeed to that degree of fatness that they almost nauseate; and this, a late author, a gentleman of considerable estate near Manchester, attributes to the fat grease and oyles, which by the Woke-mills are expressed from the woolen cloaths, and so mixed with the water. And indeed, considering the number of these mills standing upon that river, and the extraordinary fatness of the eeles, I do not think the conjecture amiss." (Nat. Hist. of Lancash. p. 143.) Pennant, too, dilates with somewhat of epicurean gusto upon another delicacy from our shores. "*Ne fraudentur gloria sua littora.* I must, in justice to Lancashire, add that the finest mussels are those called *Hambleton Hookers*, from a village in that county. They are taken out of the sea, and placed in the river *Weir*, within reach of the tide, where they grow very fat and delicious." (Zool. iv, 237.)

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* In the British Room of the British Museum is a specimen of the Forked Beard (*Phycis furcatus*) about two feet long, and labelled from Liverpool. I am not aware, however, of its history. The Phycis is rare on the British coasts.

Of more imposing fishes, I may mention that a *Sturgeon* twelve feet long has been taken in the Mersey, near Warrington, "in a salmon-fishery belonging to Mr. Thos. Patten, of that town," (Leigh, plate 6), and a *Sword-fish (Xiphias gladius)* is recorded by Pennant, (Zool. iii, 217), as having been taken "in October, 1785, in the new cut for the Dee, above Flint."

I have referred to these fishes somewhat out of their place because of their great interest, and of the importance which they give to our Fauna. And, before quitting the inhabitants of our waters, I may perhaps mention the visits of some large cetaceans, which have been recorded from time to time. Besides the specimens of *Hyperöodon Butzkopf*, described in the Fauna, there are notices of two other species of this genus having been found, viz., *Hyperöodon latifrons*, on the coast of Lancashire, (*Knight's Cyclopædia*, Art. CETACEA,) and *H. rostratum*; the skeleton of the latter species (which was taken at the mouth of the Mersey) is in the museum of the Royal Institution. This is the specimen of which we read in the *Bolton Chronicle* for May 2nd, 1829, "A large whale of the beak-nosed kind was taken last week on this coast, near Liverpool." (See *Loudon's Magazine*, vol. ii, p. 391.) A Bottle-head whale *(H. Butzkopf)*, is also recorded by Pennant, as having been found "in the recess of the tide in the new cut of the river Dee, below Chester," whose length was twenty-four feet, and girth twelve feet. This was in October, 1785' The Bottle-nose dolphin *(Delphinus tursio)* is stated by Jenyns to have been taken in the Ribble, at Preston (Bell, 470). Our own river also (Mersey) has, within the last twelve months, been honoured with the visit of a rare species of whale, new to Britain *(Megaptera longimana)* whose skeleton now forms a very imposing object in the museum.

So also, *Seals* have occasionally come up our rivers. Dr. Leigh mentions a "sea-calf seal," as taken in the *Ribbel;* and Pennant (Zool. i, 177) describes a pied seal (*Phoca bicolor*) of which he says, "this I saw at Chester; it was taken near that city in May, 1766." This appears to have been an individual of the species *Monachus albiventer,* (Gray, Mus. Cat.), a rare Mediterranean species, of which this is the only specimen recorded as captured upon British coasts.

Records of true Quadrupeds,* however, are very scarce in the zoological annals of Lancashire and Cheshire, and those of Reptiles, as might be anticipated from the paucity of species, are very unfrequent. A correspondent of Loudon's Magazine (vol. ix, p. 317) mentions the Natter-jack toad as common at Bootle, though not existing anywhere else, he adds, as far as I can learn; they make a great noise, and are called *Bootle organs.*"

But, of Birds there are sufficient to raise these counties, and particularly Lancashire, into an interesting historical district. It is not easy to say why this should be, inasmuch as that county cannot be said to occupy any especially central or otherwise favorable situation, so far as regards the ordinary birds of passage or flight. It is true, however, that possessing a large extent of seaboard, and several large meres, it offers facilities to water-fowl, whether grallatorial or natatorial, and we shall see that these have a considerable share in the list.

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* As this may be regarded as a Zoological History of these counties, it may be mentioned that the Water Shrew (*Sorex fodiens*) was known to Dr. Merret in the 17th century, but for a whole century was lost until it was rediscovered in Lancashire about 1770.

Few of our rarer British birds excel the *rose-coloured Pastor* (*Pastor roseus*) in beauty. One of the earliest specimens recorded was taken near Ormskirk, where it is related, " one and sometimes more " have been shot (Penn) ; another at Salford. And we read in Loudon's Magazine (vol. iv, 734), that in August, 1830, one was shot near Eccles. Mr. Blackwall also (Researches in Zoology) remarks, " this elegant species has, I believe, been found to occur more frequently in Lancashire than in any other part of the kingdom." Another of the thrush tribe, the golden Oriole (*Oriolus galbula*), was taken at Gorton fields, near Manchester, in 1811 ; and again in Quernmore park, near Lancaster ; the latter specimen is now in the museum of that town. (Yarr.) In May, 1830, one was taken at Toxal, in Cheshire, which is preserved in the Manchester museum. (Loudon, iv, 73.) Other interesting birds are spoken of as met with from time to time, as the pied flycatcher, said, by Pennant, to be more common in Lancashire and Yorkshire than in the rest of England—the Hoopoe (*Upupa epops*), the great grey Shrike (*Lanius excubitor*), the Waxwing (*Bombycilla garrula*), of which several were obtained in the vicinity of Middleton, Lancashire, in 1829, and which have recently re-appeared in the county—the grey wagtail (*Motacilla boarula*) of which, though a northern bird, Yarrell says, that in Lancashire and Cumberland, it is not only found all the summer, producing its young, but a few remain during winter. These last four birds (the pied flycatcher, hoopoe, waxwing, and grey wagtail,) also find a place in our recent Fauna list. The dipper (*Cinclus aquaticus*) inhabits some parts of Cheshire, and the tree-sparrow (*Passer montanus*) seems to have long been known as a frequenter of the neighbourhood of Chat Moss.

Lancashire appears to have been the southern limit of distribution of the Black Grouse (*Tetrao tetrix*), and the northern limit (on the west side of the island) of the lesser spotted Woodpecker (*Picus minor*). With regard to the latter genus, a species was described by Pennant under the name of the middle spotted woodpecker (*Picus medius*) as having been met with in Lancashire. This, however, was an error, as he himself imagined, the birds so characterised being only the young of the great spotted woodpecker (*Picus major*). The true *Picus medius* of Linnæus is a continental form, which has never been met with in this country. Another, and much rarer woodpecker, is the great black woodpecker (*P. martius*), concerning which not a little doubt has been experienced as to its ever having been met with in this country. Montagu, in his supplement to the *Ornithological Dictionary*, says, "Lord Stanley assures us that he shot a *Picus martius* in Lancashire."* Yarrell tells us that "the specimen of the black woodpecker, formerly in the collection of Mr. Donovan (who was well known to give very high prices for British-killed birds, for his own use in his *History of British Ornithology*), was affirmed to have been shot in this country. At the sale of Mr. Donovan's collection, this specimen was purchased by the Earl of Derby."†

The pine Grosbeak (*Pyrrhula enucleator*) and the Crossbill (*Loxia curvirostra*) are recorded as rare visitors; but there is one little bird which has recently been added to our district Fauna list, and which possesses a peculiar interest in this place. This is the Pettychaps, or Garden Warbler (*Curruca hortensis*), one of the sweetest of our summer songsters, which was first observed in Lancashire by Sir Ashton Lever, who obtained specimens in this county, and communicated them to Dr. Latham, at Dartford, by whom they were first described. One of the few specimens of the Lapland bunting (*Plectrophanes lapponica*), also, the fourth British one, was caught near Preston, and was taken to the Manchester market, where it was observed among a number of other small birds, and is now preserved in the Manchester museum. Among birds of prey, the Goshawk (*Astur palumbarius*) is remarkable, for being a northern bird of which Mr. Selby says that he had never seen a recent specimen south of the Tweed, but adds, that "it is known to breed on the wooded banks of the Dee." Nor would this list of curious and rare birds be complete without reference to the "Brasilian magpye," described and figured by Leigh (Table of ye Birds, fig. 2) "that was driven upon the coasts by the violent Hale storm, described in Mr. Burghers' first plate, and found dead upon the sea coast of Lancashire." The figure given resembles in every respect a species of Toucan. Fig. 3 of the same plate is called the "Tropick bird, driven in at the same time," and is described as "a bird all white (except only a short red beak) about the bigness of a pigeon."

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* Yarrell repeats this statement, and the same may be found in Latham's "General History of Birds," 1822, vol. 3, page 340. Under these circumstances, we might have hoped to have found the specimen in our Museum. But in the edition of Latham, annotated by the late Earl of Derby, and now in the possession of the present Earl, the passage, "one was killed in Lancashire by Lord Stanley," is erased, and in the margin is written in his Lordship's own hand—"*a mistaken idea.*"

† I regret to say, however, that I have been unable to discover this specimen in our collection.

Cheshire abounds not only with rivers and brooks, but also with broad sheets of water called *meres*. The principal of these are Oak mere, Pick mere, Budworth mere, Rosthern mere, Mere mere, Tatton mere, Chapel mere, Moss mere, Broad mere, Bah mere, and Comber mere. "The chefe occasion and the originale by likelihood of the manifolde Poolys and Lakes in Chestershire, was by digginge of Marle fattynge the baren Grownd there to beare good Corne. To the whiche Pitts the Faulle of the water thereabout and the springs hathe resortyd, and bysydes the Grownd there beynge so depely dikid, there be many springs risynge naturally in them." (Leland vii, 11). Nor is Lancashire altogether deficient in them, while it possesses long level reaches of sand left bare at every tide, at Morecambe bay, as well as a long stretch of sea coast indented with the estuaries of the Ribble and the Mersey.

It is not, therefore, surprising that a great many aquatic birds should have been observed, several of them possessing considerable interest. Among these stand pre-eminent the great or Double Snipe (*Scolopax major*) which was first described as a British bird by Pennant (Zool. ii, 62) from a specimen shot in Lancashire, and preserved in the Leverian museum.* This species was at that time considered to be very rare, but it was probably undistinguished from the common snipe (*S. gallinago*); and the Editor of the last edition of Pennant (1812) says, "I have known the species to be killed in England six or eight times, and it is probably met with oftener than imagined, as sportsmen talk of killing snipes occasionally of an extraordinary size." Another species, Sabine's snipe, (*S. Sabini*), is so rare that it is only known to have occurred half a dozen times, and then in the British Islands. One of these was taken at Clitheroe, in Lancashire, August 14th, 1820. Another bird which owes its first discovery as British to Lancashire, is the collared Pratincole (*Glareola torquata*), the capture of which is recorded in the eleventh volume of the *Linnæan Transactions* by Mr. Bullock of the London museum, who says, "the first instance of this bird having been killed in Britain occurred in 1807, when one was shot in the neighbourhood of Ormskirk, in Lancashire; it was preserved by Mr. J. Sherlock, of that place, from whom I purchased it a few days afterwards."

*** At the dispersion of the Leverian Museum, many specimens found their way into our own, and I hoped to have discovered this historical specimen in our own collection. I have searched for it, however, in vain: but we have an example killed by Mr. Hornby, at Winwick.**

This specimen came into the possession of the Earl of Derby, and is now in good preservation in our own Museum. A second specimen was killed by the same Mr. Bullock in the Isle of Uist. It was sold with the contents of his museum, in 1819, and was bought for eight guineas and transferred to the British Museum. In the last edition of Pennant's Zoology, vol. ii, p. 110, our specimen was referred to under the name of Austrian pratincole (*Glareola Austriaca*), where it is said, " a solitary instance occurs of this curious bird, which seems to unite the swallow and the tern tribe, having visited England. It was shot in Lancashire."

Another bird of considerable interest to us is the glossy Ibis (*Ibis falcinellus*), which, though not uncommon, is still an accidental visitor to this country. Yarrell tells us that " one occurred some years ago in Lancashire, and is preserved in the collection of the Earl of Derby in that county." That specimen also is now in our Museum. This bird receives a certain amount of interest from the fact that it is believed by some to be the *Liver* which figures upon the Liverpool arms. Montagu says, " the Ibis is adopted as a part of the arms of the town of Liverpool. This bird is termed a Liver, from which that flourishing town derived its name, and is now standing on the spot where the *Pool* was, on the verge of which the *Liver* was killed." On this passage, however, Yarrell remarks, " the arms of the town of Liverpool are, however, comparatively modern, and seem to have no reference to the Ibis. The bird has been adopted in the arms of the Earl of Liverpool, and in a recent Edition of *Burke's Peerage*, is described as a cormorant holding in the beak a branch of sea-weed. In the Plantagenet seal of Liverpool, which is believed to be of the time of King John, the bird has the appearance of a dove, with a sprig of olive, apparently intended to refer to the advantages that commerce would derive from peace. For a drawing of this ancient seal, (he says), with various other particulars, and also for a notice of the recent occurrence of an Ibis near the town of Fleetwood, on the river Wyre, I am indebted to the kindness of John Skaife, Esq., of Blackburn." (II, 572.)*

The same gentlemen has in his possession a male and a female specimen of the Green Sandpiper (*Totanus ochropus*) that were shot at the end of July, 1837, on a small brook that falls into the Darwen, about three and a half miles south of Blackburn; and circumstances had induced the belief that this pair had bred in the neighbourhood. Another species of sandpiper, of the genus *Tringa,* is even more interesting from its rarity and from its having been taken within the limits of our own district. This is the Buff-breasted Sandpiper (*Tringa rufescens*), of which the third of the few specimens known as British was taken at Formby on the banks of the Alt, and was sent to Liverpool market for sale along with some snipes. It was a male, and is now preserved in the collection of the Rev. T. Staniforth, of Bolton Rectory, Skipton. The little Crake also (*Crex pusilla*) was taken in 1807, at Ardwick meadows, near Manchester.

A spurious species of coot is described by Pennant as having been discovered in Lancashire. This he calls the Great Coot (*Fulica aterrima*), and says that it differs from the common coot only in its superior size, and the exquisite blackness of its plumage. But modern authors reject it as a species, and consider it to be only the adult bird, of a more decided dark colour—a mere variety.

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* After all the discussions upon the identity of this bird, I confess I cannot see any reason to differ from the ingenious description given in *Archæologia,* vol. 21, p. 543, by Wm. Hamper, Esq. As he observes—" Mr. Gregson, in his Portfolio of Fragments, pronounces this heraldic description (of a cormorant) as dubious, observing that it has been cut and carved by our artists in all shapes, from that of a goose to a long-necked heron." Without disputing as to the legend upon the modern seal, there can be no doubt that this modern seal is a copy, and a bad one, of an older seal. In both the ancient and the modern seal, however, we have a bird which has neither the long legs of a heron, nor the long neck of a liver (?), but is as good a representation of a *dove bearing an olive branch* as we could expect to see in such a situation. The etymology of the name of Leverpool, or Liverpool, is, doubtless, topographical rather than heraldic or armorial; indeed, Mr. Hamper gives us reason to believe that the heraldic Lever is a bunch of *Flagges,* vert., as in the arms of Levermore, of Devonshire.

Two birds, esteemed as great delicacies, were formerly much more common in our counties than they are at present. I refer to Ruffs and Woodcocks. The ruffs (*Machetes pugnax*) are chiefly found in the fenny districts of Lincolnshire, Cambridgeshire and Norfolk; but Pennant informs us that in his time they visited a place called Martin Mere, in Lancashire, at the latter end of March or beginning of April, though they did not continue there more than three weeks (Zool. ii, 75, note). With regard to Woodcocks (*Scolopax rusticola*), he says in his Tour, that in the northern parts of Lancashire he saw "on the plains numbers of springes for woodcocks, laid between tufts of heath, with avenues of small stones on each side, to direct these foolish birds into the snares, for they will not hop over the pebbles. Multitudes are taken in this manner in the open weather, and sold on the spot for sixteen pence or twenty pence a couple (twenty years ago at sixpence or sevenpence), and sent to the all-devouring capital by the Kendal stage.

There are several heronries mentioned in Cheshire, but I do not know of any in Lancashire. They are at *Dunham Massey*, the seat of the Earl of Stamford and Warrington; *Combermere Abbey*, the seat of Viscount Combermere; *Hooton*, on the Mersey, the seat of R. C. Naylor, Esq.; *Ardley Hall*, the seat of R. E. Warburton, Esq.; and *Oulton Park*, the residence of Sir Philip Egerton, Bart., M.P.

Among natatorial birds, Bewick's swan (*Cygnus Bewickii*) is remarkable; for a flock of twenty-nine of these rare birds is recorded as having visited the neighbourhood of Manchester, on Dec. 10th, 1829, an account of which circumstance appeared in Mr. Blackwall's *Researches in Zoology*,—" one of these was wounded, and remained on a reservoir during nearly a year, the first four months of which it was voluntarily joined by another of the flock." There is also a specimen in the Manchester Museum, which was obtained in the fish market of that town. The beautiful harlequin duck (*Fuligula histrionica*) the red-breasted Merganser (*Mergus serrator*) and the roseate Tern (*Sterna Dougalii*), have occurred, the first in Cheshire, and the second and third on the Lancashire coast. The great crested Grebe (*Podiceps cristatus*) was long known to breed on some of the Cheshire meres, and Pennant figures a species which he calls the *Tippet grebe,* as having been met with on Rostherne mere in Cheshire; but it appears to have been only an immature individual of the last species. The little Auk, however (*Mergulus melanoleucos*), appears to have been originally a Lancashire bird, since Pennant, who first described it as British, speaks only of one specimen, and says, "the bird our description was made from, was taken in Lancashire." One was taken alive at Sale, in Cheshire, 1824 (December 10th), and is now in the Manchester Museum. Lastly, the fork-tailed petrel (*Thalassidroma Leachii*) has been found both in Lancashire and Cheshire, blown inland by heavy gales from the north-west. (Loudon.)

Thus far I have confined myself to the Vertebrate Fauna, and have endeavoured to show that the counties of Lancashire and Cheshire have a zoological history of no inconsiderable interest. I have, however, yet to consider, but more briefly, the host of invertebrated animals, chiefly marine, some of which add greatly to this historical interest. For it is a noticeable fact that although we had not, a century back, a Montague upon our coast, whose researches had anticipated the work of recent observers; and further, that although no one appears to have investigated the productions of our shores until almost the present generation, when the labours of Mr. Tudor at Bootle, and Mr. Price at Birkenhead, first made our district classical; nevertheless the researches of these gentlemen, recent as they are, have, to a certain extent, already become matters of history. For in a growing community such as Liverpool and Birkenhead, whose importance has kept pace with the facilities for the passage to and fro of ships, with the extension of docks, and with the enlargement of warehouse space, it is a natural consequence that the conservation of the river for these ends, the construction of embankments and dock-walls, have so changed the aspect of the river's banks, that many localities which once yielded objects of the highest interest to the zoologist have been totally destroyed, and the marine animals which made those localities remarkable, have disappeared with them.

In the published histories of British Invertebrate groups, the counties of Lancashire and Cheshire do not occupy a very prominent position as sources of material. Regarded from this point of view, which may to a certain extent be taken as an index of the historic richness of this district, we shall find that the labours of former observers have been represented by only two or three groups. Mollusca in general have not any remarkable history, nor can any one be named previously to the present generation in connection with this large and important group, and all, therefore, that we know of the molluscous animals of our shores is embodied in our recent Fauna. Pennant states that *Venus* (*Cytherea*) *chione* had been found on the Cheshire coast, but that shell has no place in our present Fauna. So also Da Costa (British Conchology, p. 213,) mentions *Tellina bimaculata* as occasionally found in Lancashire. "This is a species considered by some naturalists to have been introduced erroneously into British catalogues. Its occasional appearance on our shores is probably to be ascribed to the frequent wreck of vessels from the West Indies, where it is abundant." Forbes and Hanley, i, 310.) *Turbo exoletus* (*Turritella cincta* of modern conchologists) is another shell of which somewhat the same might be said. It is an African form, but recorded by Da Costa from Lancashire. (See Linnæan Transactions, viii, 176.) One circumstance is particularly worthy of record in this place, for the knowledge of which I am indebted to my friend Mr. Byerley. It refers to *Mya arenaria*, a shell which was at one time found but rarely, and then dead. About ten years since, however, Mr. Byerley found that in a large piece of salt-water, enclosed by the recently constructed sea-wall immediately south of Seacombe slip, and to which the sea had access by a small opening, *Mya arenaria* occurred in great numbers, and often of peculiar form. The valves, instead of being of the ordinary form, were more or less twisted, sometimes as much so as in the case of the shell called *Arca tortuosa*. In addition to this peculiarity, a remarkable variation occurred in the interior. A lamina of the nacreous layer was separated from the interior of the shell, which thus formed a pouch into which a portion of the adductor muscle was inserted. In the same pool, and burrowing in the mud, might be found a number of magnificent *Dorsibranchiate* annelids, a foot long, of the species *Eunice gigantea*, (?) but the locality from which these interesting animals were once obtained in plenty no longer exists, and a busy ship-building yard now stands upon the spot.

One family of Mollusca, however, has a zoological history in connection with the estuaries of the Mersey and Dee, viz., the Nudibranchiata. Some of these are at present peculiar to those rivers, and the researches of Messrs. Price, Byerley and others, have indissolubly connected their names with the history of British Nudibranchs. In the Mersey, two species have been discovered by Mr. Price, which have no other locality. These are *Embletonia pallida*, and *Doris proxima*. The former was a minute species, described, but not figured in Alder and Hancock's great work, (Appendix, p. xii.) and differing, (if it really differed, however, and was more than an immature specimen) from the other British species, *E. pulchra,* in having a double series of papillæ on each side, the tentacles placed nearer together, and the oral lobes small and indistinct, being united over the head in front, into a semi-circular veil. It is to be regretted that no figure of this supposed species occurs, since no other specimen has been found, and the locality is now either destroyed or so altered by the construction of the Birkenhead docks, as to render the discovery of another highly improbable.

Another species of Nudibranch may be claimed as a special possession of the district. This is *Antiopa hyalina,* an extremely beautiful form, first made known in 1851 by Mr. Byerley, who discovered it at Hilbre Island, at the mouth of the Dee. The figure in Alder and Hancock's work was made from this individual, which proved, however, to be an inferior specimen. Again, in 1854, the species was found in the same spot as before, a much finer specimen, and a third specimen occurred in 1859. Since then it has also once been taken. There are few instances of a species so well marked as *Antiopa hyalina,* recurring so often in the same spot, to the exclusion of all other localities; and the presence of this single species gives an interest to the Dee which is not surpassed by any other river.

An interest of a similar kind is given to the Mersey by the discovery in it of a species of Nudibranch, which though peculiar to the district proves to be not uncommon in the Mersey, nor indeed wholly confined to it, since it has also been found in the Dee. This is *Doris proxima,* a species first made known to Mr. Alder by Mr. Price of Birkenhead. At first it appeared to be a mere variety of *Doris aspera,* but closer examination disclosed points wherein it differed very importantly from that rather common form. But the remarkable fact is, that although commonly met with in these rivers, it has, to the best of my knowledge, never been recorded hitherto as found anywhere else. On the other hand *Doris aspera* is unknown in the Mersey and Dee.

But besides these three species which are of such peculiar historical interest, it may be mentioned that of *Doris subquadrata*, first discovered at Torbay in 1845, the second specimen was found in the Dee in 1851; of *Eolis Landsburgii* found at Saltcoats in 1846, the second specimen was found in the Dee in 1849; while of *Eolis concinna*, of which four specimens were first taken at Whitley, in Northumberland, specimens were found for the second time in the Mersey in 1859.

There are but two other groups of invertebrate animals whose history in this country is connected with the counties of Lancashire and Cheshire. These are Spiders and Zoophytes. No connected history of the former has appeared prior to the publication of Blackwall's "Spiders of Great Britain and Ireland" by the Ray Society. Owing to the fact of a few gentlemen located in Lancashire, in the neighbourhood of Manchester and Southport having taken up the subject numerous discoveries of species have been made which clearly indicate that the science of Arachnology in England has but made a beginning, and that there is a wide field for future research. The numerous species which have been met with but once or twice, and the richness of the few localities in which diligent spider-hunters happen to have resided fully prove this, and hence Lancashire has a permanent zoological and historical interest in connection with this class of animals. I will enumerate the more interesting species which have been discovered in this country.

Of the following Spiders the only specimens recorded have been taken in our county, viz., *Salticuss parsus*, on the walls of Crumpsall Hall, near Manchester, in summer of 1828, (Annals, 2nd ser., vol. vii, p. 401). *S. floricola*, on the sandhills at Southport, by the Rev. O. Pickard-Cambridge, in

1859. *S. Blackwallii,* near the sea-shore at Southport, discovered by the Rev. Hamlet Clark in 1855. *Drassus pumilus,* of which the Rev. O. P. Cambridge discovered an adult female on the sandhills at Southport, in June, 1859. *Philodromus oblongus,* has been taken only in the north of Lancashire and Cheshire. *Drassus reticulatus,* was captured by Mr. Walker, near Lancaster, in 1850. *Linyphia vivax,* described in the Linnæan Trans., xviii, 657, from specimens discovered in the greenhouses and melon-pits belonging to Mr. Darbyshire, of Green Heys, near Manchester, in Sept., 1836. *Linyphia gracilis,* of which mature males were found on rails at Crumpsall Hall, in Nov., 1836. (Linn. Tr., xviii, 666.) *Neriene rufipes,* obtained at Crumpsall, in 1832; *N. lugubris,* also obtained in the same locality in 1834. *N. trilineata,* not uncommon in the neighbourhood of Manchester, concealing itself under stones. *N. abnormis,* taken at Crumpsall Hall, in Oct., 1836; *Walcknaera turgida,* in the same place also in 1836. *W. aggeris,* at Southport, in 1859, by Rev. O. P. Cambridge. *W. humilis,* first obtained in Oct., 1836, under slates in a garden at Crumpsall Green, afterwards on rails at Crumpsall Hall, and in 1840 near Garstang, by Miss Clayton; and *W. fastigiata,* described from specimens found among moss at Southport, by Rev. O. P. Cambridge, in June, 1859.

Many interesting species also are recorded as having been first taken in Lancashire, though subsequently found elsewhere;—as *Drassus clavator,* discovered by the Rev. O. P. Cambridge, on the sandhills at Southport, in 1859, and afterwards at Portland. *Linyphia Claytoniæ,* of which the original description was made from adult males taken by Miss Ellen Clayton, near Garstang, and described in the Linnæan Trans., xviii, p. 664. *Linyphia insignis,* the original specimen of which was an adult female, captured by Mr. John Parry, at Trafford, near Manchester, in the autumn of 1837. (Linn. Trans., xviii, p. 662.) *Neriene gracilis,* first taken at Crumpsall Hall, in 1836. *N. munda*, also first discovered by Miss E. Clayton, at Garstang, in 1840. (Linn. Trans., xviii, 642.) *N. dubia*, of which the first specimen was captured at Crumpsall Hall, in 1836. *Walcknaera acuminata*, first taken by Mr. Thos. Blackwall, in 1832, in the township of Crumpsall. *W. monoceros*, discovered by Rev. O. P. Cambridge, at Southport, in 1859. *W. obscura*, at Crumpsall Hall, in 1834. *W. flavipes*, at same place, also in 1834. *W. cristata*, found in Oct., 1832, by Mr. Thos. Blackwall, in the neighbourhood of Manchester. *W. picina*, by Mr. T. Glover, in 1838, also in the neighbourhood of Manchester. *W. frontata*, at Crumpsall Hall, in autumn of 1832; since then at Lancaster, and in Cheshire; and *Pachygnatha Clerkii*, discovered by Mr. T. Blackwall, among rubbish in the township of Crumpsall, in 1831.*

A few Insects also deserve notice as connected with our historical Fauna. *Lithosia molybdeola*, has been taken only on the Lancashire mosses. *Nyssia zonaria*, was originally discovered upon the sandhills of New Brighton and Crosby, and since then at Hoylake, Puddington, and Point of Air. *Rhodaria sanguinalis*, which occurs abundantly upon the Wallasey sandhills, has only been taken as rare isolated specimens in one or two other localities of England and Ireland. Mr. Brockholes, who gives me this information, also states that *Ephestia interpunctella* occurs in the streets of Liverpool, and nowhere else, to his knowledge, except London. *Pterophorus Loewii*, has only been found at Southport; and, *Tinea flavescentella*, is now being introduced into Liverpool, probably from abroad, being brought into the port by ships trading with Central America.

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* In addition to this most interesting list of Spiders identified historically with Lancashire, many other species are found in this county among the few localities which are known for them. Of these I will merely enumerate the following list:—

Salticus frontalis
S. distinctus
Thomisus erraticus
Philodromus cespiticolis
Clubiona comta (rare)
Cœlotes saxatilis
Theridion pallens
T. filipes
Pholcus phalangioides (Liverpool)
Linyphia fuliginea
L. rubea
L. alticeps
L. longidens
Neriene marginata
N. errans
N. vagans (very common)
N. pygmæa (do.)
N. cornuta (rare)
N. rubens
N. nigra (rare, aeronautic)
N. fusca
Walcknaera cuspidata (rare)
Pachygnatha Listeri
P. Degeerii
Dysdera Hombergii (common)

But, it is somewhat remarkable that none of the rarer Epëiridæ have been met with in Lancashire.

There remain but a few words to be said upon the subject of the Zoophytes, including the Polyzoa and Hydrozoa. Mr. Tudor, of Bootle, made investigations with regard to these which require notice, inasmuch as no history of British Zoophytes is complete which omits his name. He supplied many notices of species, which occurred in Bootle Bay, to Dr. Johnston, and to Dr. Landsborough, and both authorities refer to specimens received from him. Dr. Landsborough acknowledges the finest specimens of *Thuiaria articulata* and *Campanularia verticillata*, as Bootle specimens. *Flustra carbasea* (*Carbasea papyrea ?*) also is mentioned by both as rare here, on Mr. Tudor's authority, but I am not aware of its having occurred of late years. The species *Sertularia margareta* of Hassall, appears to have been really an original Liverpool one, inasmuch as the late Dr. Johnston expressly states, (Brit. Zooph., vol. i, p. 73,) that he received it from Mr. Tudor, who obtained it at the mouth of the Mersey; and adds, "With respect to the discovery of this *Sertularia*, I feel it necessary to state that specimens were sent to me from Mr. Tudor through my ardent friend Mr. T. G. Rylands, of Bewsey House, many months previously to its publication by Mr. Hassall." One other species we may claim, namely, *Cellularia* (*Bugula*) *neritina*, of which the late Dr. Fleming (History of British Animals) says, "I possess a specimen from the collection of the late Dr. Walker, which he received from Miss Blackburne, from the coast of Cheshire." It is rare, however, on the English coasts, and does not occur in our recent lists.

I have thus endeavoured to bring together, from the most varied and comprehensive sources, the scattered materials for the History of the Fauna of Lancashire and Cheshire, and have, I trust, proved that though these counties have not been the favoured residence of many of the industrious workers in this branch of science, they are by no means devoid of interest, but have borne their share in the work of discovery, and have afforded not a little aid in the enlargement of our knowledge of the productions of nature in the British Islands.

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Transactions of the Royal Scottish Society of Arts, vol. 6, part 3	*The Society.*
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Proceedings of the Royal Geographical Society, vol. 8, No. 2	*The Society.*

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APPENDIX.

THE LEPIDOPTERA

OF THE

HUNDRED OF WIRRAL,

CHESHIRE.

Read before the Society, 8th February, 1864.

BY

J. FITZHERBERT BROCKHOLES, ESQ.

PREFACE.

In offering to the Society this list of the Lepidoptera of the Hundred of Wirral, I am aware that Mr. Byerley previously published one for the whole neighbourhood round Liverpool. Since then, the old classification of these insects has been entirely superseded by a more elaborate and correct one. Since that time also, the knowledge possessed by local entomologists has become more extended, and their researches have brought to light many species which had not previously been found in the district. I have considered it unadvisable to use an obsolete classification in recording these additions, and equally injudicious to combine the old one with the new; I have therefore concluded to present an entirely new list.

Moreover, there are errors of nomenclature in the old list, especially amongst the smaller and more obscure insects, which arose from the imperfect knowledge of those who gave the information. Thus, the Ornix Meleagripennella of the old list, is the Gracilaria Tringipennella of the new; Chrysoclista Linneella is Gelechia Hermannella, the real Linneella, to the best of my knowledge, never having been found here. The specimens of Nepticula Gratiosella were merely N. Aurella. These three species were incorrectly named, and, I have no doubt that if a collection of that date had remained unaltered to the present time, examination and comparison would have pointed out other similar errors. If it be understood that information concerning Lepidoptera was then principally legendary, and that there were few older cabinets in the neighbourhood to refer to, it will be readily imagined how easily mistakes might arise.

Before, however, leaving the subject of the old list, I must congratulate the author on the able and painstaking manner in which he got it up.

The present list is drawn up with every care, and I offer it in the belief that it is correct as far as it goes; I say as far as it goes, because, I have no doubt future research will discover many additions. The whole of Wirral has not as yet been examined. Moreover, fresh species occasionally appear in old localities.

I have not worked much on the Lancashire side of the Mersey round Liverpool, so that I am not in a position to write a list from my own knowledge of the Lepidoptera found there. No doubt the majority are enumerated here, but there are a few species in and near Liverpool which have not as yet been found in Cheshire. Independently of the neighbourhood, there is a good field for research amongst the warehouses and stores of Liverpool.

With reference to this list, the person whose name is given with any statement is accountable for that statement, and the compiler is responsible for the remainder. I take this opportunity of thanking those who have so kindly assisted me.

Those species which have no notice of rarity or locality appended, must be understood as more or less abundant and generally distributed.

Of course, the changes which are taking place in and near Birkenhead are only too likely to influence the Lepidopterous fauna of that neighbourhood. Some local species may be destroyed there, and others introduced amongst woollen goods and other merchandise.

There is a good field for speculation in the apparent rarity or extinction of some species in the Hundred. Why, for instance, have some kinds been taken on a single occasion only, in a dozen or fifteen years? Have these strayed from some more distant part, or are they the offspring of such as have died out through not finding the conditions necessary for existence?

On the other hand, all are liable to be more plentiful in some seasons than in others, owing to certain peculiarities of season being more favourable for their development, and perhaps to the existence of fewer enemies at that time than at others. It is difficult, if not impossible, to assign a reason why moths should come freely to a known attraction on perhaps an unfavourable night, whilst scarcely a specimen is to be seen during evenings which seem the most propitious.

There is a noticeable difference in the time of appearance of insects generally distributed, according to the soil on which they are found. On the sand hills and sandy loam of Wallasey they are earlier than on the more inland clayey soils. These again, are earlier than those of the low, wet soil of the Upton valley. Thus, I have taken Epunda lutulenta in wasted condition at the end of August, near Wallasey; in good condition during September at Rock Ferry, and when getting wasted there, I have gone to the Upton valley and continued to take it in good condition in October. On the whole, the neighbourhood is rich in Lepidoptera, though the Rhopalocera and Sphingina are not specifically numerous.

The classification and nomenclature are those used in Stainton's "Manual of British Butterflies and Moths."

ERRATA.

Page 7, *for* Pamphilia, *read* Pamphila.
,, 9, ,, Notodonidæ, ,, Notodontidæ.
,, 9, ,, Choania, ,, Chaonia.
,, 9, ,, Dictoæides, ,, Dictæoides.
,, 9, ,, Antigua, ,, Antiqua.
,, 10, ,, Stilpnoptia, ,, Stilpnotia.
,, 10, ,, Artcia, ,, Arctia.
,, 10, ,, Jacobæa, ,, Jacobææ.
,, 13.—Transpose lines 3 and 4.
,, 13, *for* Heliophobis, *read* Heliophobus.
,, 14, ,, Cubibularis, ,, Cubicularis.
,, 15, ,, Orbono, ,, Orbona.
,, 17, ,, Scapelosoma, ,, Scopelosoma.
,, 19, ,, Lithoriza, ,, Lithorhiza.
,, 24, ,, Immitaria, ,, Imitaria.
,, 26, ,, Subfulveria, ,, Subfulvaria.
,, 28, ,, Derivaria, ,, Derivata.
,, 32, ,, Truncicolla, ,, Truncicolella.
,, 37, ,, Ungicella, ,, Unguicella.
,, 39, ,, Gralholita, ,, Grapholita.
,, 43, ,, Euonymellus ,, Evonymellus.
,, 46, ,, Getechia, ,, Gelechia.

LEPIDOPTERA.

RHOPALOCERA.

Family PAPILIONIDÆ.

Sub-Family PIERIDI.

Genus GONEPTERYX.

GONEPTERYX RHAMNI.

Seen by Mr. Almond at Upton.

Genus COLIAS.

COLIAS EDUSA.

Is occasionally met with but apparently is not permanent. I have seen it near Neston.

Genus PIERIS.

PIERIS BRASSICÆ.

PIERIS RAPÆ.

PIERIS NAPI.

Genus ANTHOCARIS.

ANTHOCARIS CARDAMINES.

More abundant at Puddington and Mollington than round Birkenhead.

Family NYMPHALIDÆ.

Sub-Family SATYRIDI.

Genus LASIOMMATA.

LASIOMMATA ÆGERIA.

Sparingly at Prenton. Puddington. Abundant near Queen's Ferry. *Mr. Almond.*

LASIOMMATA MEGÆRA.

Genus HIPPARCHIA.

HIPPARCHIA SEMELE.

Abundant on Wallasey sand hills. Bidston Hill.

HIPPARCHIA JANIRA.

HIPPARCHIA TITHONUS.

Genus CŒNONYMPHA.

CŒNONYMPHA PAMPHILUS

Bidston Hill. Rock Ferry.

Sub-Family VANESSIDI.

Genus CYNTHIA.

CYNTHIA CARDUI.

Is seen occasionally.

Genus VANESSA.

VANESSA ATALANTA.

Not abundant round Birkenhead. Common at Puddington.

VANESSA IO.

VANESSA ANTIOPA.

I have seen one near Prenton Mount.

VANESSA POLYCHLOROS.

I have seen one in Prenton Wood.

VANESSA URTICÆ.

Genus GRAPTA.

GRAPTA C. ALBUM.

Once taken by Mr. Diggles, Tranmere.

Sub-Family ARGYNNIDI.

Genus ARGYNNIS.

ARGYNNIS AGLAIA.

Not abundant. Wallasey sand hills.

Genus MELITÆA.

MELITÆA ARTEMIS.

In a single instance near Eastham.—*Mr. S. Archer.*

Family LYCÆNIDÆ.

Genus THECLA.

THECLA QUERCUS.

I have bred one from a larva found in Eastham Wood.

Genus CHRYSOPHANUS.

CHRYSOPHANUS PHLÆAS.

Genus POLYOMMATUS.

Polyommatus alexis.

Polyommatus ægon.

Bidston Hill.

Family HESPERIDÆ.

Genus THANAOS.

Thanaos tages.

Formerly abundant at Gill Brook, Birkenhead.—*Mr. Almond.* Scarce at Prenton.

Genus PAMPHILIA.

Pamphila linea.

Near Eastham.—*Messrs. S. and F. Archer.*

Pamphila sylvanus.

Between Raby and Bromborough.—*Mr. F. Archer.*

HETEROCERA.

Group SPHINGINA.

Family ZYGÆNIDÆ.

Genus ANTHROCERA.

Anthrocera lonicerae.

Bidston Marsh.—*Mr. N. Cooke.* I stored larva on the side of Bidston Hill opposite Upton.

Anthrocera filipendulæ.

Family SPHINGIDÆ.

Genus SMERINTHUS.

Smerinthus Ocellatus.

Smerinthus populi.

Genus ACHERONTIA.

Acherontia atropos.

Scarce.

Genus SPHINX.

Sphinx convolvuli.

A specimen was taken some years ago by Mr. J. Leyland, near Oxton.

Genus DEILEPHILA.

Deilephila galii.

Scarce. Wallasey sand hills.

Genus CHÆROCAMPA.

Chærocampa elpenor.

Chærocampa porcellus.

Most abundant on Wallasey sand hills.

Family SESIIDÆ.

Genus MACROGLOSSA.

Macroglossa stellatarum.

Scarce. Wallasey.

Genus SESIA.

Sesia fuciformis.

Scarce. Bidston.

Family ÆGERIIDÆ.

Genus SPHECIA.

Sphecia bembeciformis.

Common in the north of Wirral.

Group BOMBYCINA.

Family HEPIALIDÆ.

Genus HEPIALUS.

Hepialus hectus.

Bromborough. Eastham. Puddington.

Hepialus lupulinus.

Hepialus humuli.

Hepialus velleda.

Eastham Wood.

Hepialus sylvinus.

Liscard. Bidston Marsh. Tranmere. Rock Ferry. Burton.

Family ZEUZERIDÆ.

Genus COSSUS.

Cossus ligniperda.

Does not appear abundant now.

Family NOTODONIDÆ.

Genus CERURA.

Cerura furcula.

Scarce.

Cerura bifida.

Cerura vinula.

Genus NOTODONTA.

Notodonta dromedarius.

Not common. Bidston. Claughton. Rock Ferry.

Notodonta ziczac.

Genus PTEROSTOMA.

Pterostoma palpina.

In a single instance this spring (1864) at Puddington.

Genus DRYMONIA.

Drymonia choania.

A specimen was taken some years ago by Mr. B. Cooke. Eastham Wood.

Genus LEIOCAMPA.

Leiocampa dictæa.

Leiocampa dictoæides.

Scarce. Bidston.

Genus LOPHOPTERYX.

Lophopteryx camelina.

Genus DILOBA.

Diloba cæruleocephala.

Scarce. Bidston. Puddington.

Genus PYGÆRA.

Pygæra bucephala.

Family LIPARIDÆ.

Genus DASYCHIRA.

Dasychira fascelina.

Common on Wallasey sand hills. Occurs more sparingly inland.

Dasychira pudibunda.

Genus ORGYIA.

Orgyia antigua.

Genus STILPNOPTIA.

STILPNOTIA SALICIS.

Not common. Wallasey. Bidston. Hoylake.—*Mr. F. Archer.*

Genus PORTHESIA.

PORTHESIA AURIFLUA.

Family LITHOSIDÆ.

Genus LITHOSIA.

LITHOSIA COMPLANULA.

Scarce. Wallasey. Bidston. Puddington.

LITHOSIA GRISEOLA.

Scarce. Wallasay. Bidston.

Genus NUDARIA.

NUDARIA MUNDANA.

Scarce. Tranmere. Puddington.

Family CHELONIDÆ.

Genus ARTCIA.

ARCTIA CAJA.

Genus PHRAGMATOBIA.

PHRAGMATOBIA FULIGINOSA.

Genus SPILOSOMA.

SPILOSOMA MENTHRASTI.

SPILOSOMA LUBRICEPEDA.

Genus DIAPHORA.

DIAPHORA MENDICA.

Taken by Mr. Diggles. Tranmere.

Genus CALLIMORPHA.

CALLIMORPHA JACOBÆA.

Common on Wallasey sand hills.

Family BOMBYCIDÆ.

Genus LASIOCAMPA.

LASIOCAMPA RUBI.

Wallasey sand hills. Bidston Hill. Less frequent elsewhere.

LASIOCAMPA TRIFOLII.

Wallasey sand hills.

LASIOCAMPA QUERCUS.

Genus PŒCILOCAMPA.

Pœcilocampa populi.

Bidston. Has been taken in Birkenhead.

Genus CLISIOCAMPA.

Clisiocampa neustria.

Upton valley.

Genus ERIOGASTER.

Eriogaster lanestris.

Upton valley.

Genus ODONESTIS.

Odonestis potatoria.

Family SATURNIDÆ.

Genus SATURNIA.

Saturnia pavonia-Minor.

Family PLATYPTERYGIDÆ.

Genus CILIX.

Cilix spinula.

Not abundant round Birkenhead. Common at Puddington.

Family PSYCHIDÆ.

Genus FUMEA.

Fumea nitidella.

Patrick Wood near Bromborough Mills. Near Lower Bebington.—*Mr. F. Archer.*

Group NOCTUINA.

Sub-Group TRIFIDÆ.

Section BOMBYCIFORMES.

Family NOCTUO-BOMBYCIDÆ.

Genus THYATIRA.

Thyatira derasa.

Bidston. Claughton. Tranmere. Puddington.

Thyatira batis.

Less frequent than the last. Eastham. Puddington.

Genus CYMATOPHORA.

Cymatophora duplaris.

Scarce. Prenton Wood.

Cymatophora flavicornis.

Scarce. Bidston Park Wood.

Family BRYOPHILIDÆ.

Genus BRYOPHILA.

Bryophila perla.

Family BOMBYCOIDÆ.

Genus ACRONYCTA.

Acronycta psi.

Acronycta leporina.

Scarce. Bidston.

Acronycta megacephala.

Acronycta rumicis.

Section GENUINÆ.

Family LEUCANIDÆ.

Genus LEUCANIA.

Leucania conigera.

Rock Ferry.—*Mr. Almond.*

Leucania lithargyria.

Leucania littoralis.

Wallasey sand hills.

Leucania comma.

Leucania impura.

Leucania pallens.

Genus NONAGRIA.

Nonagria fulva.

Bidston Marsh. Tranmere. Puddington.

Nonagria despecta.

Ledsham.

Nonagria typhæ.

Nonagria crassicornis.

Bidston Marsh. Burton. Scarce at Puddington.

Family APAMIDÆ.

Genus GORTYNA.

GORTYNA FLAVAGO.

Genus HYDRÆCIA.

Formerly more abundant round Birkenhead than at present.

HYDRÆCIA NICTITANS.

Common near Wallasey and Seacombe. I saw one once in Claughton.

HYDRÆCIA MICACEA.

Genus AXILIA.

AXILIA PUTRIS.

Genus XYLOPHASIA.

XYLOPHASIA RUREA.

XYLOPHASIA COMBUSTA, VAR.

Everywhere with the insect.

XYLOPHASIA LITHOXYLEA.

XYLOPHASIA POLYODON.

XYLOPHASIA HEPATICA.

Puddington.

Genus HELIOPHOBIS.

HELIOPHOBIS POPULARIS.

Genus CHARÆAS.

CHARÆAS GRAMINIS.

Wallasey sand hills.—*Mr. J. Cooke.* Burton.

Genus CERIGO.

CERIGO CYTHEREA.

Genus LUPERINA.

LUPERINA TESTACEA.

LUPERINA CESPITIS.

Near Wallasey.

Genus MAMESTRA.

MAMESTRA ABJECTA.

Two were taken some years ago by Messrs. Almond and Warrington in Claughton fir-wood.

MAMESTRA ANCEPS.

MAMESTRA ALBICOLON.

Wallasey sand hills.

MAMESTRA BRASICÆ.

Genus APAMEA.

Apamea basilinea.

Apamea gemina.

Apamea oblonga, var.

Scarce. Wallasey.

Apamea unanimis.

Wallasey. Rock Ferry. Puddington.

Apamea oculea.

Genus MIANA.

Miana strigilis.

Miana fasciuncula.

Miana literosa.

Margin of Wallasey sand hills.

Miana furuncula.

Wallasey sand hills. Burton.

Miana arcuosa.

Scarce. Bidston Marsh.—*Mr. Almond.* Puddington.

Family CARADRINIDÆ.

Genus GRAMMESIA.

Grammesia trilinea.

Grammesia bilinea, var.

Rock Ferry. Scarce elsewhere.

Genus CARADRINA.

Caradrina morpheus.

Near Wallasey.

Caradrina alsines.

Scarce. Wallasey. Bromborough.

Caradrina blanda.

Caradrina cubibularis.

Family NOCTUIDÆ.

Genus RUSINA.

Rusina tenebrosa.

Scarce. Wallasey. Bidston. Puddington.

Genus AGROTIS.

Agrotis valligera.

Wallasey sand hills.

Agrotis puta.

I took one specimen some years ago near Wallasey.

Agrotis suffusa.

Agrotis saucia.

Scarce except in 1858. Bidston.—*Mr. Almond.* Upton valley. Eastham Wood.

Agrotis segetum.

Agrotis exclamationis.

Agrotis corticea.

Near Wallasey.

Agrotis cursoria.

Was formerly more plentiful than at present. Wallasey sand hills.

Agrotis nigricans.

Occasionally taken. Wallasey sand hills.

Agrotis tritici.

Wallasey sand hills.

Agrotis aquilina.

I have occasionally taken it on Wallasey sand hills.

Agrotis obelisca.

Scarce. Wallasey sand hills.—*Mr. N. Cooke.*

Agrotis agathina.

A specimen was taken by Mr. Almond in August, 1854. Wallasey sand hills.

Agrotis porphyrea.

Bidston Hill. Claughton fir-wood. Prenton Mount Wood.

Agrotis præcox.

Not abundant. Wallasey sand hills.

Genus TRIPHÆNA.

Triphæna ianthina.

Not abundant. Tranmere. Rock Ferry. Puddington.

Triphæna fimbria.

Scarce. Wallasey. Claughton. Eastham Wood.

Triphæna interjecta.

Scarce. Wallasey.

Triphæna orbono.

Triphæna pronuba.

Genus NOCTUA.

Noctua augur.

Noctua plecta.

Noctua C–nigrum.

Most abundant near Wallasey.

Noctua triangulum.

Rather sparingly scattered through the district.

Noctua brunnea.

Scarce. Bidston.—*Mr. Almond.* Rock Ferry. Burton.

Noctua festiva.

Noctua bella.

Noctua umbrosa.

Noctua baja.

Noctua xanthographa.

Family ORTHOSIDÆ.

Genus TRACHEA.

Trachea piniperda.

In the fir-woods of Bidston, Claughton, Prenton, and Storeton. I took a specimen or two also, in Eastham Wood, some years ago.

Genus TÆNIOCAMPA.

Tæniocampa gothica.

Tæniocampa rubricosa.

Tæniocampa instabilis.

Tæniocampa opima.

Not abundant. Near Wallasey. Leasowe. Bidston.

Tæniocampa populeti.

Scarce, but generally distributed.

Tæniocampa stabilis.

Tæniocampa gracilis.

Tæniocampa munda.

Bromborough. Eastham Wood. Puddington.

Tæniocampa cruda.

Most abundant in Eastham Wood.

Genus ORTHOSIA.

Orthosia upsilon.

Wallasey.

Orthosia lota.

Orthosia macilenta.

Scarce at Rock Ferry. Common in Eastham Wood. Puddington.

Genus ANTHOCELIS.

ANTHOCELIS RUFINA.

Rather scarce. Bromborough.—*Messrs. Almond and Chant.* Eastham Wood. Puddington.

ANTHOCELIS PISTACINA.

ANTHOCELIS LUNOSA.

ANTHOCELIS LITURA.

Genus CERASTIS.

CERASTIS VACCINII.

Bidston. Rock Ferry. Abundant in Eastham Wood. Puddington.

CERASTIS SPADICEA.

Much less abundant than the last.

Genus SCAPELOSOMA.

SCAPELOSOMA SATELITIA.

Bidston. Abundant in Eastham Wood. Puddington.

Genus XANTHIA.

XANTHIA CITRAGO.

Rock Ferry. More abundant at Puddington.

XANTHIA CERAGO.

XANTHIA FLAVAGO.

Less frequent than the last. Bidston. Claughton. Tranmere. Puddington.

XANTHIA FERRUGINEA.

Family COSMIDÆ.

Genus TETHEA.

TETHEA SUBTUSA.

Not common. Wallasey. Bidston. Tranmere. Puddington.

Genus COSMIA.

COSMIA TRAPEZINA.

Family HADENIDÆ.

Genus DIANTHÆCIA.

DIANTHÆCIA CAPSINCOLA.

DIANTHÆCIA CUCUBALI.

Scarce. Wallasey. Puddington.

DIANTHÆCIA CONSPERSA.

Mr. Warrington took one some years ago. Tranmere.

Genus POLIA.

POLIA CHI.

Bidston. Puddington. Burton.

Genus DASYPOLIA.

DASYPOLIA TEMPLI.

I took one several years ago at Bidston Lighthouse.

Genus EPUNDA.

EPUNDA LUTULENTA.

Scarce; Wallasey. Upton Valley. Rock Ferry.

EPUNDA LICHENEA.

Wallasey. Has been taken also at Bidston.—*Mr. Almond.*

Genus MISELIA.

MISELIA OXYACANTHÆ.

Genus AGRIOPIS.

AGRIOPIS APRILINA.

Bidston. Rock Ferry. Eastham Wood. Puddington.

Genus PHLOGOPHORA.

PHLOGOPHORA METICULOSA.

Genus EUPLEXIA.

EUPLEXIA LUCIPARA.

Genus APLECTA.

APLECTA OCCULTA.

I took one several years ago near the Manor House, Claughton.

APLECTA NEBULOSA.

Bromborough.—*Mr. Almond.* Eastham Wood. Ledsham.

APLECTA HERBIDA.

Ledsham.

Genus HADENA.

HADENA ADUSTA.

Wallasey. Puddington.

HADENA PROTEA.

Rock Ferry. Puddington.

HADENA DENTINA.

HADENA SUASA.

Scarce. Wallasey. Bidston Marsh.

HADENA OLERACEA.

HADENA PISI.

Most abundant near New Ferry.

HADENA THALASSINA.

Wallasey. Rock Ferry. Puddington.

HADENA CONTIGUA.

I took one specimen in 1860. Rock Ferry.

Family XYLINIDÆ.

Genus XYLOCAMPA.

XYLOCAMPA LITHORIZA.

Bidston. Tranmere. Eastham. Puddington.

Genus CALOCAMPA.

CALOCAMPA VETUSTA.

Scarce; Wallasey. Bidston. Upton Valley.

CALOCAMPA EXOLETA.

Not abundant.

Genus XYLINA.

XYLINA RHIZOLITHA.

I took a specimen in 1859. Upton Valley.

Genus CUCULLIA.

CUCULLIA CHAMOMILLÆ.

Several were taken by Mr. Almond some years ago. Bidston Hill.

CUCULLIA UMBRATICÆ.

Not plentiful. Wallasey. Bidston.

Family HELIOTHIDÆ.

Genus HELIOTHIS.

HELIOTHIS MARGINATA.

Generally scarce. I took the larva freely in 1857. Wallasey. Near New Ferry.

HELIOTHIS ARMIGERA.

A specimen was taken in 1857, by Mr. Almond, on the salt marsh near the mouth of Bromborough Pool.

Genus ANARTA.

ANARTA MYRTILLI.

Bidston Hill. Claughton fir-wood. Prenton Mount Wood.

Genus HELIODES.

HELIODES ARBUTI.

Prenton Lane. Puddington.

Sub-Group QUADRIFIDÆ.

Section VARIEGATÆ.

Family PLUSIDÆ.

Genus ABROSTOLA.

Abrostola triplasia.

Scarce; Wallasey. Tranmere. Oxton. Puddington.

Genus PLUSIA.

Plusia chrysitis.

Most abundant near Bromborough Mills, and at Puddington.

Plusia festucæ.

Round Birkenhead. Puddington.

Plusia iota.

Puddington.

Plusia pulchrina.

Seems scarce. Puddington.

Plusia gamma.

Family GONOPTERIDÆ.

Genus GONOPTERA.

Gonoptera libatrix.

Rather scarce.

Section INTRUSÆ.

Family AMPHIPYRIDÆ.

Genus AMPHIPYRA.

Amphipyra tragopoginis.

Genus MANIA.

Mania typica.

Mania maura.

Bidston. Claughton. Upton Valley. Rock Ferry. Puddington.

Section SERPENTINÆ.

Family EUCLIDIDÆ.

Genus EUCLIDIA.

Euclidia mi.

Scarce. Wallasey sand hills.

Euclidia glyphica.

Near Shotwick.—*Mr. Almond.* A specimen near Eastham.—*Mr. F. Archer.*

Family POAPHILIDÆ.

Genus PHYTOMETRA.

Phytometra ænea.

Bidston Hill.

Group GEOMETRINA.

Family OURAPTERYDÆ.

Genus OURAPTERYX.

Ourapteryx sambucaria.

Formerly in Clifton Park. Has been recently taken by Mr. Chant near Tranmere. Common at Puddington.

Family ENNOMIDÆ.

Genus EPIONE.

Epione apiciaria.

Not plentiful. Wallasey. Rock Ferry. Puddington.

Genus RUMIA.

Rumia Cratægata.

Genus METROCAMPA.

Metrocampa Margaritata.

Genus ELLOPIA.

Ellopia fasciaria.

Scarce. Prenton Mount Wood. Burton.

Genus EURYMENE.

Eurymene Dolobraria.

Scarce. Rock Ferry. Eastham Wood.—*Mr. Almond.*

Genus SELENIA.

Selenia illunaria.

Selenia lunaria.

Scarce. Rock Ferry. Puddington.

Genus ODONTOPERA.

Odontopera bidentata.

Genus CROCALLIS.

Crocallis elinguaria.

Not abundant.

Genus ENNOMOS.

Ennomos tiliaria.

Clifton Park and adjacent part of Birkenhead. Claughton Park.—*Mr. Almond.* Does not seem so plentiful as formerly.

Ennomos fuscantaria.

Scarce. Upton Valley. North Birkenhead.

Ennomos erosaria.

Scarce. Tranmere. Rock Ferry.—*Mr. Almond.*

Genus HIMERA.

Himera pennaria.

North Birkenhead and Eastham Wood.—*Mr. Almond.* Puddington.

Family AMPHIDASIDÆ.

Genus PHIGALIA.

Phigalia pilosaria.

In most woods.

Genus NYSSIA.

Nyssia zonaria.

Formerly abundant on Wallasey sand hills. Hoylake sand hills. Puddington Marsh. It maintains existence in a portion of the last locality which is often covered by the tide.

Genus AMPHIDASIS.

Amphidasis prodromaria.

Has been taken by Mr. Galliers as recorded in the *Intelligencer*, Eastham Wood.

Amphidasis betularia.

Family BOARMIDÆ.

Genus HEMEROPHILA.

Hemerophila abruptaria.

Scarce. Upton. Tranmere. Rock Ferry.

Genus CLEORA.

Cleora lichenaria.

Scarce at Frankby. Prenton Wood.

Genus BOARMIA.

Boarmia repandata.

Boarmia rhomboidaria.

Not plentiful. Tranmere. Puddington.

Genus GNOPHOS.

GNOPHOS OBSCURATA.

Wallasey. Bidston. Tranmere. Burton.

Family GEOMETRIDÆ.

Genus PSEUDOTERPNA.

PSEUDOTERPNA CYTISARIA.

Bidston Hill. Claughton fir-wood.

Genus GEOMETRA.

GEOMETRA PAPILIONARIA.

Scarce. Bidston. Rock Ferry. Ledsham.

Genus IODIS.

IODIS LACTEARIA.

Genus HEMITHEA.

HEMITHEA THYMIARIA.

Not abundant.

Family EPHYRIDÆ.

Genus EPHYRA.

EPHYRA PUNCTARIA.

Scarce. Eastham Wood.

Family ACIDALIDÆ.

Genus ASTHENA.

ASTHENA LUTEATA.

Scarce. Puddington. Burton.

ASTHENA CANDIDATA.

Rather scarce. Wallasey. Bidston.

Genus EUPISTERIA.

EUPISTERIA HEPARATA.

Not very common. Rock Ferry. Burton. Puddington.

Genus ACIDALIA.

ACIDALIA SCUTULATA.

ACIDALIA BISETATA

ACIDALIA OSSEATA.

Not uncommon. Margin of sand hills near Wallasey Village.

ACIDALIA VIRGULARIA.

Not scarce on Bidston Hill. Occasionally taken elsewhere.

ACIDALIA SUBSERICEATA.

Scarce. Bidston.

ACIDALIA REMUTATA.

ACIDALIA IMMITARIA.

Bidston.

ACIDALIA AVERSATA.

Most frequent in woods.

Genus BRADYEPETES.

BRADYEPETES AMATARIA.

Not common. Puddington.

Family CABERIDÆ.

Genus CABERA.

CABERA PUSARIA.

CABERA EXANTHEMATA.

Genus CORYCIA.

CORYCIA PUNCTATA.

Mr. Almond took specimens in Eastham Wood.

Family MACARIDÆ.

Genus MACARIA.

MACARIA LITURATA.

Rather scarce. Prenton Mount Wood.

Genus HALIA.

HALIA WAVARIA.

Family FIDONIDÆ.

Genus STRENIA.

STRENIA CLATHRATA.

Puddington.

Genus LOZOGRAMMA.

LOZOGRAMMA PETRARIA.

Formerly on Flaybrick Hill.—*Mr. Almond.* Bidston Park Wood. Eastham Wood.

Genus NUMERIA.

NUMERIA PULVERARIA.

Scarce. Claughton. Tranmere. Rock Ferry. Eastham Wood.

Genus MÆSIA.

MÆSIA BELGIARIA.

Scarce. Bidston Hill.

Genus FIDONIA.

FIDONIA ATOMARIA.

Burton.

FIDONIA PINIARIA.

Fir woods of Bidston, Prenton, Storeton and Burton. I took a specimen also near Queen's Ferry.

Family XERENIDÆ.

Genus ABRAXAS.

ABRAXAS GROSSULARIATA.

ABRAXAS ULMATA.

Bidston. Rock Ferry. Puddington. Eastham.—*Mr. F. Archer.*

Genus LOMASPILIS.

LOMASPILIS MARGINATA.

Family HYBERNIDÆ.

Genus HYBERNIA.

HYBERNIA RUPICAPRARIA.

HYBERNIA LEUCOPHEARIA.

Scarce in Prenton Wood. Patrick Wood near Bromborough mills. Eastham Wood. Scarce at Puddington.

HYBERNIA AURANTIARIA.

I have taken one. Puddington.

HYBERNIA PROGEMMARIA.

HYBERNIA DEFOLIARIA.

Rather scarce. Bidston. Upton. Has been taken in Birkenhead. Eastham Wood. Ledsham.

Genus ANISOPTERYX.

ANISOPTERYX ÆSCULARIA.

Family LARENTIDÆ.

Genus CHEIMATOBIA.

CHEIMATOBIA BRUMATA.

Genus OPORABIA.

OPORABIA DILUTATA.

Tranmere. Puddington.

OPORABIA FILIGRAMMARIA.

Mr. Almond has taken it on Bidston Hill.

Genus LARENTIA.

LARENTIA DIDYMATA.

LARENTIA MULTISTRIGARIA.

Wallasey. Bidston. Burton.

LARENTIA MIARIA.

LARENTIA OLIVARIA.

Bidston.—*Mr. Almond.*

Genus EMMELESIA.

EMMELESIA AFFINITATA.

EMMELESIA ALCHEMILLATA.

Patrick Wood, near Bromborough mills.—*Messrs. Almond and Warrington.* Puddington.

EMMELESIA ALBULATA.

EMMELESIA DECOLORATA.

EMMELESIA UNIFASCIATA.

Scarce. Wallasey sand hills.—*Mr. N. Cooke.*

Genus EUPITHECIA.

EUPITHECIA LINARIATA.

Bidston. Tranmere.

EUPITHECIA PULCHELLATA.

Scarce. Prenton Mount Wood. Rock Ferry. Burton.

EUPITHECIA CENTAUREATA.

Wallasey. Bidston.

EUPITHECIA SUCCENTURIATA.

Scarce at Wallasey. More frequent near Tranmere. Puddington.

EUPITHECIA SUBFULVERIA.

Wallasey. Burton.

EUPITHECIA PYGMÆATA.

Puddington.

EUPITHECIA SATYRATA.

I bred a specimen some years ago, but I do not know where I got the larva. It was obtained near Birkenhead. Burton.

EUPITHECIA CASTIGATA.

EUPITHECIA INNOTATA.

Scarce. Rock Ferry. Puddington.

EUPITHECIA INDIGATA.

Scarce. Prenton Mount Wood. Burton.

EUPITHECIA CONSTRICTATA.

A specimen accidently bred. Clifton Park. Burton.

EUPITHECIA NANATA.

Bidston Hill. Claughton fir wood. Prenton Mount Wood.

EUPITHECIA SUBNOTATA.

Scarce. Wallasey. Birkenhead.

EUPITHECIA VULGATA.

EUPITHECIA ABSYNTHIATA.

EUPITHECIA ASSIMILATA.

EUPITHECIA ABREVIATA.

Eastham Wood. Puddington.

EUPITHECIA EXIGUATA.

Puddington.

EUPITHECIA PUMILATA.

Bidston Hill. Claughton fir wood.

EUPITHECIA RECTANGULATA.

Occasionally taken.

Genus LOBOPHORA.

LOBOPHORA HEXAPTERATA.

Rather scarce. Puddington.

Genus THERA.

THERA VARIATA.

In most fir woods.

THERA FIRMARIA.

Not abundant. Prenton Mount Wood. Puddington.

Genus YPSIPETES.

YPSIPETES IMPLUVIATA.

In most woods.

YPSIPETES RUBERARIA.

Occurs with the last. Are they really distinct species?

YPSIPETES ELUTATA.

Genus MELANTHIA.

MELANTHIA RUBIGINATA.

Rock Ferry. Puddington. Ledsham.

MELANTHIA PLUMBATA, VAR.

Ledsham.

MELANTHIA OCELLATA.

Tranmere. Prenton Mount Wood. Burton.

Genus MELANIPPE.

MELANIPPE UNANGULATA.

Not common. Neighbourhood of Flaybrick Hill. Tranmere. Ledsham. Puddington.

MELANIPPE BIRIVIATA.

Sub-Group PYRALITES.

Family PYRALIDÆ.

Genus PYRALIS.

Pyralis Farinalis.

Generally found where corn, meal, &c., are stored. I bred several from amongst moss obtained on the river bank near New Ferry.

Genus AGLOSSA.

Aglossa pinguinalis.

Stables and outhouses.

Family ENNYCHIDÆ.

Genus PYRAUSTA.

Pyrausta Purpuralis.

Wallasey sand hills. Ledsham.

Pyrausta ostrinalis.

Wallasey sand hills.

Genus RHODARIA.

Rhodaria sanguinalis.

Wallasey sand hills.

Genus HERBULA.

Herbula cespitalis.

Genus ENNYCHIA.

Ennychia cingulalis.

Wallasey sand hills.

Family HYDROCAMPIDÆ.

Genus CATACLYSTA.

Cataclysta lemnata.

Genus PARAPONYX.

Paraponyx stratiotata.

Bidston Marsh.

Genus HYDROCAMPA.

Hydrocampa nymphæata.

Hydrocampa stagnata.

Family BOTYDÆ.

Genus BOTYS.

Botys fuscalis.

Botys terrealis.

In a single instance. Puddington.

Botys urticata.

Genus EBULEA.

Ebulea sambucalis.

Amongst elders. Birkenhead.

Genus PIONEA.

Pionea forficalis.

Genus SPILODES.

Spilodes sticticalis.

Scarce. Near Wallasey.

Genus SCOPULA.

Scopula lutealis.

Scopula olivalis.

Scopula prunalis.

Scopula ferrugalis.

Wallasey sand hills. Bidston. Rock Ferry.

Genus STENOPTERYX.

Stenoteryx hybridalis.

Family NOLIDÆ.

Genus NOLA.

Nola cuculatella.

Formerly plentiful in a hedge which has been destroyed, Bidston Marsh. Occasionally taken elsewhere. Abundant, Puddington.

Nola cristulalis.

Seems scarce. Puddington.

Family CHOREUTIDÆ.

Genus SIMÆTHIS.

Simaethis fabriciana.

Sub-Group CRAMBITES.

Family EUDOREIDÆ.

Genus EUDOREA.

Eudorea Cembræ.

Scarce. I took this species on the ground now occupied by the entrances to the Great Float, at Birkenhead.

EUDOREA AMBIGUALIS.

EUDOREA PYRALELLA.

Ledsham. Puddington.

EUDOREA TRUNCICOLLA.

Amongst fir trees.

EUDOREA FREQUENTELLA.

Common on Bidston Hill. Puddington.

EUDOREA MURANA.

Locality forgotten.

EUDOREA ANGUSTEA.

EUDOREA PALLIDA.

Bidston Marsh.

Family GALLERIDÆ.

Genus APHOMIA.

APHOMIA COLONELLA.

Has been taken occasionally. Wallasey. Puddington. Burton.

Family PHYCIDÆ.

Genus ANERASTIA.

ANERASTIA LOTELLA.

Wallasey sand hills.

Genus EPHESTIA.

EPHESTIA ELUTELLA.

About houses.

Genus OMŒOSOMA.

OMŒOSOMA NIMBELLA.

Wallasey sand hills.

Genus ACROBASIS.

ACROBASIS CONSOCIELLA.

I took a single specimen on a lamp in Clifton Park.

Genus CRYPTOBLABES.

CRYPTOBLABES BISTRIGA.

Scarce. Bidston Park Wood. Taken also by the late Mr. Langcake not far from Birkenhead, but I do not know where.

Genus PEMPELIA.

PEMPELIA FUSCA.

Bidston Hill. Claughton fir wood.

PEMPELIA PALUMBELLA.

Seems scarce. Bidston Hill.

Family CRAMBIDÆ.

Genus CRAMBUS.

CRAMBUS PRATELLUS.

CRAMBLS DUMETELLUS.

Wallasey sand hills.

CRAMBUS PASCUELLUS.

Bidston Marsh. Claughton fir wood. Burton.

CRAMBUS HORTUELLUS.

CRAMBUS CULMELLUS.

CRAMBUS GENICULEUS.

Wallasey sand hills.

CRAMBUS CONTAMINELLUS.

Rather scarce. Puddington.

CRAMBUS TRISTELLUS.

CRAMBUS SELASELLUS.

Puddington.

CRAMBUS LATISTRIUS.

Formerly not uncommon on a bank, which has since been destroyed, Claughton fir wood. Has been occasionally taken between there and Flaybrick Hill.

CRAMBUS PERLELLUS.

Marshes of Bidston, Bromborough, and Puddington.

Genus CHILO.

CHILO FORFICELLUS.

Scarce. Bidston Marsh. Burton.

CHILO PHRAGMITELLUS.

Scarce. Bidston Marsh.—*Mr. Almond.*

Family CHLOEPHORIDÆ.

Genus CHLOEPHORA.

CHLOEPHORA PRASINANA.

Occasionally taken. Rock Ferry. Eastham Wood. Puddington.

Group TORTRICINA.

Family TORTRICIDÆ.

Genus AMPHISA.

AMPHISA GERNINGIANA.

Heaths of Bidston Hill, Oxton and Claughton.

Genus HYPERMECIA.

HYPERMECIA AUGUSTANA.

Beaten occasionally from hedges.

Genus EULIA.

EULIA MINISTRANA.

Genus BRACHYTÆNIA.

BRACHYTÆNIA SEMIFASCIANA.
BRACHYTÆNIA HARTMANNIANA.

I am not certain which of these two species it was that the late Mr. Langcake took on the Wallasey sand hills.

Genus ANTITHESIA.

ANTITHESIA CORTICANA.

Bidston Park Wood. Rock Ferry.

ANTITHESIA BETULETANA.

Bidston Park Wood. Rock Ferry.

ANTITHESIA PRÆLONGANA.

I took a single specimen in Bidston Park Wood.

ANTITHESIA OCHROLEUCANA.

ANTITHESIA CYNOSBATELLA.

ANTITHESIA PRUNIANA.

Genus PENTHINA.

PENTHINA SALICELLA.

Occurs in Patrick Wood about half-way between Bromborough Mills and the Birkenhead and Chester Railway.

Geuus CLEPSIS.

CLEPSIS RUSTICANA.

I took a single specimen on Bidston Marsh.

Genus TORTRIX.

TORTRIX ICTERANA.

On banks. Abundant near New Ferry.

TORTRIX VIRIDANA.

TORTRIX FORSTERANA.

TORTRIX HEPARANA.

TORTRIA RIBEANA.

TORTRIX CORYLANA.

Most frequent in woods.

Family PLICATÆ.

Genus LOZOTÆNIA.

Lozotænia musculana.

In hedges.

Lozotænia costana.

Formerly common on Bidston Marsh. Burton Marsh.

Lozotænia unifasciana.

Lozotænia fulvana.

Lozotænia rosana.

Lozotænia xylosteana.

Less frequent than the last, and not so generally distributed.

Genus DITULA.

Ditula angustiorana.

Occasionally met with.

Genus PTYCHOLOMA.

Ptycholoma lecheana.

Puddington.

Genus NOTOCELIA.

Notocelia udmanniana.

Genus PARDIA.

Pardia tripunctana.

Genus SPILONOTA.

Spilonota roborana.

Spilonota rosæcolana.

Seems scarce. Puddington.

Spilonota trimaculana.

Spilonota amœnana.

Wallasey sand hills.

Genus LITHOGRAPHIA.

Lithographia campoliliana.

Lithographia nisella.

Seems scarce. Puddington.

Genus PHLÆODES.

Phlæodes tetraquetrana.

Occasionally met with.

Phlæodes immundana.

Occasionally taken.

Genus PŒDISCA.

Pœdisca piceana.

Not abundant. Wallasey sand hills.

Pœdisca solandriana.

Pœdisca opthalmicana.

Not common. Tranmere.

Genus CATOPTRIA.

Catoptria hohenwarthiana.

Catoptria scopoliana.

Three injured specimens. Puddington.

Catoptria cæcimaculana.

I have taken one specimen. Tranmere.

Genus HALONOTA.

Halonota trigeminana.

Occasionally taken. Tranmere.

Halonota scutulana.

Formerly in Gill Brook, North Birkenhead.

Halonota brunnichiana.

Halonota tetragonana.

Genus DICRORAMPHA.

Dicrorampha petiverella.

Occasionally taken. Tranmere.

Dicrorampha tanaceti.

Genus COCCYX.

Coccyx hyrciniana.

Seems scarce. Bidston Park Wood. Puddington.

Genus CARTELLA.

Cartella bilunana.

Bidson Park Wood.

Family ANCHYLOPERIDÆ.

Genus HEDYA.

Hedya paykulliana.

Bidston Park Wood.

Hedya ocellana.

Not uncommon. Was formerly very abundant in a hedge which is now destroyed, Bidston Marsh.

Hedya dealbana.

Scarce. Puddington.

Hedya neglectana.

Hedya trimaculana.

Perhaps most abundant in Claughton Park, Birkenhead.

Genus STEGANOPTYCHA.

Steganoptycha nævana.

Occasionally taken.

Genus ANCHYLOPERA.

Anchylopera mitterbacheriana.

Anchylopera biarcuana.

Formerly not uncommon in Claughton Fir Wood. Taken occasionally elsewhere.

Anchylopera lundana.

Anchylopera ungicella.

Bidston Hill.

Genus BACTRA.

Bactra lanceolana.

Bactra furfurana.

Seems scarce. Bidston Marsh.

Genus ARGYROTOZA.

Argyrotoza conwayana.

Not uncommon. Rock Ferry.

Genus DICTYOPTERYX.

Dictyopteryx contaminana.

Dictyopteryx lœflingiana.

Amongst oaks.

Genus CRŒSIA.

Crœsia bergmanniana.

Crœsia forskaleana.

Wallasey. North Birkenhead.

Crœsia holmiana.

Tranmere.

Genus HEMEROSIA.

Hemerosia rheediella.

Occasionally taken. Prenton Lane.

Family PERONEIDÆ.

Genus CHEIMATOPHILA.

Cheimatophila mixtana.

Abundant on Bidston Hill. Claughton Fir Wood.

Genus OXYGRAPHA.

Oxygrapha literana.

Occasionally taken. Bidston. Prenton Wood. Eastham Wood.

Genus PERONEA.

Peronea comparana.

Peronea schalleriana.

Peronea potentillana.

North Birkenhead.—*Mr. Almond.* New Brighton.—*Mr. N. Cook.*

Peronea tristana.

Rock Ferry.

Peronea favillaceana.

Peronea hastiana.

Peronea permutana.

Wallasey Sand Hills.

Peronea variegana.

Genus PARAMESIA.

Paramesia aspersana.

Wallasey.

Paramesia ferrugana.

I have taken two specimens near Tranmere. Common in Eastham Wood.

Paramesia caledoniana.

Rock Ferry.

Genus TERAS.

Teras caudana.

Family STIGMONOTIDÆ.

Genus PŒCILOCHROMA.

Pœcilochroma corticana.

Most frequent in woods.

Genus EPHIPPIPHORA.

Ephippiphora regiana.

Taken by Messrs. Almond and Warrington between Poulton and Seacombe.

Ephippiphora argyrana.

Occasionally taken. Bidston Park Wood.

Genus ASTHENIA.

Asthenia coniferana.

Fir woods of Bidston and Prenton Mount. Also Burton.

Genus RETINIA.

RETINIA BUOLIANA.

Fir wood on Bidston Hill, near the Upton road.

RETINIA PINICOLANA.

In the fir woods of Bidston and Claughton.

RETINIA PINIVORANA.

Fir woods of Bidston and Claughton. Also Burton.

RETINIA OCCULTANA.

Not abundant. Claughton Fir Wood.

Family CARPOCAPSIDÆ.

Genus ENDOPISA.

ENDOPISA GERMARANA.

Not uncommon. Tranmere.

Genus CARPOCAPSA.

CARPOCAPSA SPLENDANA.

Eastham Wood.

Genus GRAPHOLITA.

GRAPHOLITA ULICETANA.

GRALHOLITA HYPERICANA.

Has been taken by Mr. Almond near Seacombe.

Family CNEPHASIDÆ.

Genus SPALEROPTERA.

SPALEROPTERA ICTERICANA.

Wallasey sand hills. Bidston Marsh.

Genus CNEPHASIA.

CNEPHASIA HYBRIDANA.

Tranmere. Burton.

CNEPHASIA SUBJECTANA.

CNEPHASIA VIRGAUREANA.

CNEPHASIA OCTOMACULANA.

Formerly occurred in a fence on Bidston Marsh which has been destroyed. Claughton. Puddington.

Genus ABLABIA.

ABLABIA PRATANA.

Bidston Marsh. Ledsham.

Family SERICORIDÆ.

Genus EUCHROMIA.

EUCHROMIA STRIANA.

Bidston Marsh. Claughton.

Genus ORTHOTÆNIA.

ORTHOTÆNIA ANTIQUANA.

Not common. Taken by the late Mr. Langcake on the Wallasey sand hills. Bidston Marsh. Burton Marsh.

Genus SERICORIS.

SERICORIS LACUNANA.

SERICORIS URTICANA.

SERICORIS CESPITANA.

Wallasey sand hills.

SERICORIS POLITANA.

Is taken occasionally.

SERICORIS LITTORALIS.

Puddington Marsh.

Family LOZOPERIDÆ.

Genus ERIOPSELA.

ERIOPSELA FRACTIFASCIANA.

Has been taken near Tranmere.

Genus CALOSETIA.

CALOSETIA NIGROMACULANA.

Wallasey. Bidston Marsh. Burton.

Genus EUPŒCILIA.

EUPŒCILIA ATRICAPITANA.

Occasionally taken all round Birkenhead.

EUPŒCILIA ANGUSTANA.

Claughton Fir Wood.

EUPŒCILIA GRISEANA.

Formerly common near Seacombe, on ground now occupied by the docks, &c. Bidston Marsh.

EUPŒCILIA RUPICOLA.

Seems scarce. Wallasey. Bidston Marsh. Puddington.

EUPŒCILIA ROSEANA.

I have bred it from Teazle found on Bidston Marsh.

EUPŒCILIA ALBICAPITANA.

Has been taken by a friend on the sand hills near New Brighton.

EUPŒCILIA RUFICILIANA.

Was formerly abundant on the ground now occupied by the entrances to the Great Float, Birkenhead. Scarce at Puddington.

Genus LOZOPERA.

LOZOPERA STRAMINEA.

Genus XANTHOSETIA.

XANTHOSETIA HAMANA.

XANTHOSETIA ZŒGANA.

Family TORTRICODIDÆ.

Genus TORTRICODES.

TORTRICODES HYEMANA.

Group TINEINA.

Family EXAPATIDÆ.

Genus CHIMABACCHE.

CHIMABACCHE PHRYGANELLA.

Eastham Wood.

CHIMABACCHE FAGELLA.

Genus SEMIOSCOPIS.

SEMIOSCOPIS STEINKELLNERIANA.

Wallasey. Bidston. Prenton and Ledsham.

Family TINEIDÆ.

Genus TALÆPORIA.

TALÆPORIA PSEUDO-BOMBYCELLA.

On the heath on Bidston Hill. Also on trunks ot trees in woods.

Genus SOLENOBIA.

SOLENOBIA INCONSPICUELLA.

Bred by Mr. Almond from cases found in Claughton Fir Wood. Cases of perhaps another species occur on trunks of trees in Bidston Park Wood, and at Puddington. Cases also occur on stones near Wallasey. As nothing but wingless females have as yet been bred from these two sets of cases, I do not know whether they are S. Inconspicuella or other species of Solenobia.

Genus DIPLODOMA.

DIPLODOMA MARGINIPUNCTELLA.

Rock Ferry.

Genus XYSMATODOMA.

Xysmatodoma melanella.

Eastham Wood.

Genus OCHSENHEIMERIA.

Ochsenheimeria birdella.

Near Seacombe, close to the Great Float.

Genus TINEA.

Tinea rusticella.

Tinea tapetzella.

Where woollen goods are stored.

Tinea arcella.

Seems scarce. Puddington.

Tinea corticella.

Puddington.

Tinea parasitella.

Seems scarce. Bidston Park Wood.

Tinea granella.

Warehouses where corn is stored, Birkenhead.

Tinea cloacella.

Tinea albipunctella.

Seems scarce. Bidston.

Tinea misella.

In outhouses.

Tinea fuscipunctella.

In houses.

Tinea pallescentella.

I took specimens in Birkenhead which I knew were imported amongst furs from Honduras. The species is probably naturalized in Birkenhead.

Tinea lapella.

Occasionally taken in woods.

Tinea biselliella.

In houses.

Tinea semifulvella.

Occasionally taken.

Tinea bistrigella.

Seems scarce. Bidston.

Genus LAMPRONIA.

Lampronia quadripunctella.

Not uncommon. Tranmere.

Genus INCURVARIA.

INCURVARIA MASCALELLA.

Genus NEMOPHORA.

NEMOPHORA SCHWARZIELLA.

Genus ADELA.

ADELA VIRIDELLA.

In oak woods.

Family MICROPTERYGIDÆ.

Genus MICROPTERYX.

MICROPTERYX SEPPELLA.

Bidston. Tranmere.

MICROPTERYX SUBPURPURELLA.

Prenton Mount Wood. Eastham Wood. Puddington.

Family HYPONOMEUTIDÆ.

Genus SWAMMERDAMIA.

SWAMMERDAMIA APICELLA.

SWAMMERDAMIA GRISEOCAPITELLA.

Occasionally taken. Bidston. Puddington.

SWAMMERDAMIA LUTAREA.

Sometimes met with. Tranmere.

SWAMMERDAMIA PYRELLA.

Genus HYPONOMEUTA.

HYPONOMEUTA PADELLUS.

HYPONOMEUTA EUONYMELLUS.

Claughton Park, Birkenhead.

Genus PRAYS.

PRAYS CURTISELLUS.

Family PLUTELLIDÆ.

Genus PLUTELLA.

PLUTELLA CRUCIFERARUM.

PLUTELLA PORRECTELLA.

Seems scarce. Rock Ferry.

PLUTELLA DALELLA.

Seems scarce. Bidston Hill. Claughton Fir Wood.

Genus CEROSTOMA.

Cerostoma vittella.

Puddington.

Cerostoma radiatella.

Cerostoma costella.

Patrick Wood, near Bromborough Mills.

Cerostoma xylostella.

Family GELECHIDÆ.

Genus ORTHOTÆLIA.

Orthotælia sparganella.

Bidston Marsh.

Genus PHIBALOCERA.

Phibalocera quercana.

Genus EXÆRETIA.

Exæretia allisella.

I once or twice met with this species rather freely in the fence separating the sand hills from the fields near Wallasey.

Genus DEPRESSARIA.

Depressaria costosa.

Wallasey. Bidston. Oxton. Puddington.

Depressaria liturella.

Depressaria umbellana.

Depressaria assimilella.

Amongst broom. Wallasey. Claughton. Tranmere.

Depressaria arenella.

Depressaria propinquella.

Wallasey. Bidston.

Depressaria subpropinquella.

Less frequent than the last. Bidston.

Depressaria alstrœmeriana.

Not uncommon. Wallasey. Leasowe. Bidston. Puddington.

Depressaria purpurea.

Occasionally met with. Wallasey. Bidston. Eastham. Puddington.

Depressaria conterminella.

Not uncommon. Wallasey. Bidston.

Depressaria angelicella.

Formerly abundant in a small plantation which has been destroyed. Bidston Marsh.

DEPRESSARIA OCELLANA.

DEPRESSARIA YEATIANA.

Wallasey. Bidston. Oxton.

DEPRESSARIA APPLANA.

DEPRESSARIA CILIELLA.

Bidston Hill. Prenton Mount Wood.

DEPRESSARIA PIMPINELLÆ.

Wallasey, and on the sand hills.

DEPRESSARIA PULCHERRIMELLA.

Leasowe. Bidston.

DEPRESSARIA NERVOSA.

DEPRESSARIA BADIELLA.

I took a single specimen some years ago on the Wallasey sand hills.

DEPRESSARIA HERACLEANA.

Bidston. Tranmere.

Genus GELECHIA.

GELECHIA CINERELLA.

Wallasey sand hills.

GELECHIA RUFESCENS.

GELECHIA POPULELLA.

Wallasey sand hills.

GELECHIA TEMERELLA.

Wallasey sand hills.

GELECHIA LENTIGINOSELLA.

North Birkenhead.

GELECHIA VELOCELLA.

Wallasey sand hills

GELECHIA FUMATELLA.

Seems scarce. Wallasey sand hills.

GELECHIA ERICETELLA.

Probably wherever heath grows.

GELECHIA MULINELLA.

Wallasey. Tranmere.

GELECHIA SORORCULELLA.

Wallasey sand hills.

GELECHIA LONGICORNIS.

Prenton Mount Wood.

GELECHIA DIFFINIS.

Wallasey. Bidston Marsh.

GETECHIA TERRELLA.

GELECHIA DESERTELLA.

Wallasey sand hills.

GELECHIA POLITELLA.

Wallasey sand hills.

GELECHIA ARTEMISIELLA.

Wallasey sand hills.

GELECHIA SENECTELLA.

Wallasey sand hills.

GELECHIA MUNDELLA.

Wallasey sand hills.

GELECHIA AFFINIS.

Wallasey sand hills.

GELECHIA DOMESTICA.

GELECHIA PROXIMELLA.

Seems scarce. Bidston Park Wood.

GELECHIA NOTATELLA.

Occasionally beaten from hedges.

GELECHIA VULGELLA.

GELECHIA ÆTHIOPS.

Prenton Mount Wood.

GELECHIA DISTINCTELLA.

Wallasey sand hills.

GELECHIA MACULEA.

I took a single specimen some years ago, most probably in Claughton.

GELECHIA TRICOLORELLA.

Bred by Mr. Almond from larvæ found near Eastham Wood.

GELECHIA MACULIFERELLA.

Wallasey sand hills.

GELECHIA MARMOREA.

Wallasey sand hills.

GELECHIA LITTORELLA.

Wallasey sand hills.

GELECHIA MOUFFETELLA.

Tranmere.

GELECHIA DODECELLA.

Fir woods of Bidston and Claughton.

GELECHIA TENEBRELLA.

Oxton.

Gelechia tæniolella.

Wallasey sand hills.

Gelechia anthyllidella.

Wallasey sand hills.

Gelechia gemmella.

Bidston. Rock Ferry.

Gelechia hermanella.

Wallasey. Oxton. Tranmere.

Gelechia ericinella.

Heath, near Oxton.

Genus PARASIA.

Parasia lappella.

Abundant between Flaybrick Hill aud Claughton Park, Birkenhead.

Genus CHELARIA.

Chelaria hubnerella.

Bidston.

Genus ANARSIA.

Anarsia spartiella.

Wallasey. Bidston.

Genus PLEUROTA.

Pleurota bicostella.

Heaths of Bidston Hill, Oxton, Claughton and Prenton Mount. Also Burton.

Genus HARPELLA.

Harpella geoffrella.

Puddington.

Family ŒCOPHORIDÆ.

Genus DASYCERA.

Dasycera sulphurella.

Genus ŒCOPHORA.

Œcophora minutella.

Seems scarce. Puddington.

Œcophora subaquilea.

Bidston Hill.

Œcophora flavifrontella.

Seems scarce. Bidston Park Wood.

Œcophora fuscescens.

Bidston Hill. Puddington.

Œcophora pseudo-spretella.

Birkenhead.

Genus ENDROSIS.

Endrosis fenestrella.

Genus BUTALIS.

Butalis grandipennis.

Bidston Hill. Oxton Heath.

Family GLYPHIPTERYGIDÆ.

Genus ACROLEPIA.

Acrolepia granitella.

I took a single specimen I think either near Bidston or Claughton.

Genus GLYPHIPTERYX.

Glyphipteryx fuscoviridella.

Tranmere. Prenton Lane

Glyphipteryx thrasonella.

Bidston Marsh. Prenton Wood.

Glyphipteryx fischeriella.

Bidston. Tranmere.

Genus PERITTIA.

Perittia obscurepunctella.

Patrick Wood, near Bromborough Mills. Puddington.

Genus TINAGMA.

Tinagma sericiellum.

Tranmere.

Family ARGYRESTHIDÆ.

Genus ARGYRESTHIA.

Argyresthia ephippella.

I took a single specimen some years ago. Locality forgotten.

Argyresthia nitidella.

In hedges.

Argyresthia semitestacella.

In hedges.

Argyresthia albistria.

In hedges.

Argyresthia conjugella.

Bidston Park Wood.

Argyresthia semifusca.

Bidston Park Wood.

Argyresthia mendica.

In hedges.

Argyresthia glaucinella.

Patrick Wood, near Bromborough Mills.

Argyresthia retinella.

In hedges.

Argyresthia pygmæella.

Near Flaybrick Hill. Tranmere.

Argyresthia goedartella.

Bidston Park Wood. Claughton. Rock Ferry.

Argyresthia brockeella.

Bidston Park Wood. Rock Ferry.

Genus CEDESTIS.

Cedestis farinatella.

Fir woods of Bidston and Claughton. Also Burton.

Genus OCNEROSTOMA.

Ocnerostoma piniariella.

Fir woods of Bidston and Claughton.

Family GRACILARIIDÆ.

Genus GRACILARIA.

Gracilaria swederella.

Gracilaria stigmatella.

Wallasey. Bidston. Puddington.

Gracilaria elongella.

Bidston. Claughton. Puddington.

Gracilaria tringipennella.

Locality near Birkenhead forgotten. Puddington.

Gracilaria syringella.

Gracilaria phasianipennella (var. quadruplella.)

In a single instance. Locality forgotten. Bidston? or Claughton?

Genus ORNIX.

Ornix anglicella.

Ornix torquillella.

Tranmere.

Ornix scoticella.

One specimen taken. Bidston Park Wood.

Ornix guttea.

Upton. Tranmere.

Family COLEOPHORIDÆ.

Genus COLEOPHORA.

COLEOPHORA JUNCICOLELLA.

Bidston Hill. Puddington.

COLEOPHORA LARICELLA.

Bidston Park Wood.

COLEOPHORA LUTIPENNELLA.

Tranmere.

COLEOPHORA FUSCEDINELLA.

Puddington.

COLEOPHORA VIMINETELLA.

Wallasey. North Birkenhead.

COLEOPHORA GRYPHIPENNELLA.

COLEOPHORA NIGRICELLA.

Tranmere. Rock Ferry.

COLEOPHORA ALCYONIPENNELLA.

Everywhere round Birkenhead.

COLEOPHORA FABRICIELLA.

In a single instance between Flaybrick Hill and Claughton Park, Birkenhead. Has been taken also by Mr. Almond in the same neighbourhood.

COLEOPHORA ANATIPENNELLA.

Wallasey sand hills. Bidston.

COLEOPHORA ALBICOSTA.

COLEOPHORA PYRRHULIPENNELLA.

Bidston Hill.

COLEOPHORA DISCORDELLA.

Wallasey sand hills. Near New Ferry.

COLEOPHORA THERINELLA?

Or new species? A single specimen taken. Wallasey sand hills.

COLEOPHORA ANNULATELLA.

Wallasey. North Birkenhead. Seacombe.

COLEOPHORA CÆSPITITIELLA.

Bidston. North Birkenhead.

Family ELACHISTIDÆ.

Genus BATRACHEDRA.

BATRACHEDRA PRÆANGUSTA.

Bidston Park Wood. Ledsham.

Genus CHAULIODUS.

CHAULIODUS CHÆROPHYLLELLUS.

Mr. Diggles took specimens near West Kirby.

Genus LAVERNA.

LAVERNA OCHRACEELLA.

Bidston Marsh. Puddington.

LAVERNA ATRA.

Tranmere.

Genus CHRYSOCLISTA.

CHRYSOCLISTA FLAVICAPUT.

In hedges.

Genus CHRYSOCORYS.

CHRYSOCORYS FESTALIELLA.

Bidston. Prenton. Eastham Wood.

Genus ELACHISTA.

ELACHISTA ALBIFRONTELLA.

ELACHISTA LUTICOMELLA.

Rock Ferry. Bromborough.

ELACHISTA NIGRELLA.

Rock Ferry.

ELACHISTA OBSCURELLA.

ELACHISTA HUMILIS.

Rock Ferry.

ELACHISTA MEGERLELLA.

Rock Ferry.

ELACHISTA CERUSELLA.

Bidston Marsh. Puddington.

ELACHISTA RHYNCHOSPORELLA.

Formerly abundant in a boggy part of Claughton Fir Wood. Houses now occupy the ground.

ELACHISTA RUFOCINEREA.

ELACHISTA CYGNIPENNELLA.

ELACHISTA OCHREELLA.

I have taken one or two specimens. Locality forgotten. Bidston Marsh.

Genus TISCHERIA.

TISCHERIA COMPLANELLA.

Eastham Wood.

TISCHERIA MARGINEA.

Family LITHOCOLLETIDÆ.

Genus LITHOCOLLETIS.

LITHOCOLLETIS CRAMERELLA.

Rock Ferry.

LITHOCOLLETIS ALNIFOLIELLA.

Locality forgotten.

LITHOCOLLETIS ULMIFOLIELLA.

Locality forgotten.

LITHOCOLLETIS POMIFOLIELLA.

Locality forgotten.

LITHOCOLLETIS FAGINELLA.

Bidston.

LITHOCOLLETIS CORYLI

LITHOCOLLETIS QUINQUEGUTTELLA.

Wallasey sand hills.

LITHOCOLLETIS QUERCIFOLIELLA.

LITHOCOLLETIS MESSANIELLA.

LITHOCOLLETIS ULICICOLELLA.

Wallasey. Prenton.

LITHOCOLLETIS CORYLIFOLIELLA.

Tranmere.

LITHOCOLLETIS FROLICHIELLA.

Bidson. Tranmere.

LITHOCOLLETIS KLEMANELLA.

Clifton Park, near Birkenhead.

LITHOCOLLETIS TRISTRIGELLA.

Bidston Park Wood.

LITHOCOLLETIS TRIFASCIELLA.

Family LYONETIDÆ.

Genus CEMIOSTOMA.

CEMIOSTOMA SPARTIFOLIELLA.

Tranmere.

CEMIOSTOMA SCITELLA.

Tranmere.

Genus BUCCULATRIX.

BUCCULATRIX AURIMACULELLA.

Bidston Pleasure-grounds.

Family NEPTICULIDÆ.

Genus NEPTICULA.

Nepticula oxyacanthella.

Tranmere.

Nepticula subbimaculella.

Nepticula salicis.

Nepticula floslactella.

Tranmere.

Group PTEROPHORINA.

Genus PTEROPHORUS.

Pterophorus ochrodactylus.

Wallasey. Tranmere. Puddington.

Pterophorus trigonodactylus.

Pterophorus punctidactylus.

Bidston. Tranmere.

Pterophorus hieracii.

Bidston.

Pterophorus bipunctidactylus.

Wallasey sand hills.

Pterophorus fuscus.

Wallasey sand hills.

Pterophorus pterodactylus.

Pterophorus pentadactylus.

Wallasey. Tranmere.

Group ALUCITINA.

Genus ALUCITA.

Alucita polydactyla.

ADDENDUM.

Euchromia Ericetana.

Ledsham.

T. BRAKELL, PRINTER, COOK STREET, LIVERPOOL.

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